SCHOOL ARITHMETICS

PRIMARY BOOK

WENTWORTH-SMITH

Sylvia Carlson

WENTWORTH-SMITH MATHEMATICAL SERIES

SCHOOL ARITHMETICS

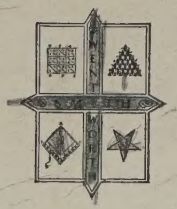
PRIMARY BOOK

BY

GEORGE WENTWORTH

AND

DAVID EUGENE SMITH



GINN AND COMPANY

BOSTON · NEW YORK · CHICAGO · LONDON

ATLANTA · DALLAS · COLUMBUS · SAN FRANCISCO

COPYRIGHT, 1919, BY GEORGE WENTWORTH
AND DAVID EUGENE SMITH
ENTERED AT STATIONERS' HALL
ALL RIGHTS RESERVED

520.11

The Athenæum Press
GINN AND COMPANY · PROPRIETORS · BOSTON · U.S.A.

PREFACE

This work is prepared to meet a demand for a book which shall present within a reasonable compass but with sufficient thoroughness the great essentials of arithmetic required in the lower grades of our schools. There are various extreme positions from which the preparation of such a book may be approached, but, as is always the case, there is also a safe mean which is certain to produce satisfactory results. One extreme makes the arithmetic operation the sole purpose, neglecting to a large extent those applications that appeal to children. Another extreme attempts to make the application the sole purpose, neglecting that steady advance in power to compute that gives to pupils the consciousness of definite progress. A third extreme seeks to make all arithmetic a matter of play without serious purpose, and still another extreme attempts to frame a textbook that is merely a collection of methods for teachers, a book that is weak in drill and weak in serious applications. No one of these extremes has ever given or, for psychological reasons, can ever give satisfactory results.

The safe mean proceeds on the supposition that the pupil should be led to his arithmetic through paths which are interesting; that he should see that he is studying a subject which is usable in school, in his play, in his home, and in all other phases of his daily life; and that, so far as possible, the applications should be real to the pupil, particularly in those grades in which his tastes are being formed and in which his outlook on life is very limited. It is possible to accomplish all this by arranging the work by arithmetic topics, showing the pupil the reason for studying each topic and the uses to which it can be applied.

In accordance with these principles this book stands for good, well-arranged mathematics, and not for the scrappy presentation which always fails to give to the pupil that feeling of mastery of the subject to which he is entitled. The book also appeals to the pupil's human interests by relating the subject to his personal needs and to the life in which he finds himself. It seeks to balance reasonably these two features, refraining on the one hand from devoting all its space to abstract drill, and on the other hand from failing, through the sacrifice of its space to methods of teaching, to give the amount of drill that is necessary. It recognizes that the children who study its pages have already been in school from one to two years, that they not only possess a fair knowledge of number but that motives for study have already begun to be formed, and that the kindergarten stage is already passing out of their lives. Devices that are needed in Grade I are not necessary in Grade III; and the teachers, to a large extent, must be the judges as to how long they shall keep to the concrete introduction to the work and as to the use they shall make of the numerous devices suggested in the book.

In a general way Chapter I is largely oral and affords a rapid review of the work of Grades I and II; Chapters II and III cover the work of Grade III; and Chapters IV and V cover the work of Grade IV; but this arrangement should not be slavishly followed. Each school should adjust the work to meet its own peculiar conditions. It will be seen that each chapter begins and ends with the necessary review work.

It is the hope of the authors that teachers will find that the series furnishes exactly the essentials for good arithmetic work in the elementary schools and presents these essentials in the most usable manner.

GEORGE WENTWORTH
DAVID EUGENE SMITH

CONTENTS

CHAPTER I

		PAGE
I.	Counting to Twelve	1
II.	Addition	5
III.	Subtraction	9
IV.	Counting to 100	13
V.	Addition	17
VI.	Subtraction	27
VII.	Measures and Fractions	31
VIII.	Minimum Essentials	45
IX.	Little Examinations	46

CHAPTER II

I.	Numbers to 1000	47
II.	Addition	51
III.	Subtraction	57
IV.	Multiplication and Division Tables	63
V.	Measures and Fractions	85
VI.	Minimum Essentials	95
VII.	Little Examinations	96

CHAPTER III

I.	Reading and Writing Numbers	97
II.	Addition	101
III.	Subtraction	105
IV.	Multiplication	109

PAGE

V. Division 119
VI. Measures and Fractions 125
VII. Minimum Essentials 133
VIII. Little Examinations 134

CHAPTER IV

I. Reading and Writing Numbers 135
II. Addition 139
III. Subtraction 145
IV. Multiplication 149
V. Division 153
VI. Measures and Fractions 169
VII. Minimum Essentials 183
VIII. Little Examinations 184

CHAPTER V

I. Reading and Writing Numbers 185
II. Addition and Subtraction 187
III. Multiplication and Division 189
IV. Measures 195
V. Fractions 209
VI. Bills and Receipts 227
VII. Solving Problems 231
VIII. Minimum Essentials 237
IX. Little Examinations 238
X. What the Pupil should Know 239

TABLES FOR REFERENCE 245
SUGGESTIONS TO TEACHERS 247
INDEX 249

SCHOOL ARITHMETICS

PRIMARY BOOK

CHAPTER I

I. COUNTING TO TWELVE

REVIEW OF COUNTING

1. John has 3 ten-cent pieces. This is equal to how many cents? Give another name to 3 tens.

2. Give another name to 7 tens; to 9 tens.

3. What short name can you give to 5 tens and 7?

4. Read these numbers:

10 17 24 38 40 56 78 91

5. Count aloud from 10 to 30; from 50 to 70.

6. Read these clock numbers if you have learned them:

II VI III V IX XI VIII XII

Notes in this type throughout the book are intended for the teacher.

This page considers orally certain numbers beyond 12 for the purpose of testing the pupils and learning what work may safely be omitted.

The first few days of the year or term should be given to a review of the essential features of the preceding work. The first part of this review should be limited to oral work and very simple written exercises. Most, if not all, of the work on pages 1–46 will be a review for nearly all the pupils, and teachers should omit such portions as may not be needed.

TAKING A RIDE

All work oral

1. Play that you are taking a ride. How many children do you see in the picture?

2. How many children are riding on the donkey?

3. How many girls are riding on the donkey?

4. How many boys are riding on the donkey?

5. How many children are on the ground?

6. If the little girl without a hat should get off, how many children would be left on the donkey?

7. Make up a problem about taking a ride.

These problems show what is called the dramatization of arithmetic; that is, acting out a real situation. Such problems are more real when planned and suggested by the teacher than when they are given in a textbook. Oral work is so specified throughout the book.

PLAYING STORE

All work oral

1. Let us play store. How many are there to play?

2. How many clerks shall we have in the store?

3. How much shall we charge for apples?

4. How many apples do you wish to buy?

5. How much shall we charge for oranges?

6. How many oranges do you wish to buy?

7. How many bottles of milk are and ?

8. John sells some blocks for building playhouses. How many blocks are and ?

9. Harry sells some dolls. He sells 4 dolls to Ruth and 3 dolls to May. How many dolls does he sell?

10. Ruth buys an orange for 6 cents. She gives the clerk 10 cents. How much change does she get?

11. Myrtie buys an orange for 5 cents and an apple for 2 cents. How much does she pay?

Because of the fact that this kind of work is more real when given orally by the teacher, only a limited amount of space can profitably be given to the subject in a book of this kind. A textbook for children should not be merely a book of methods for a teacher.

Among the common rimes that can be dramatized at this time are the following: Bo-peep, Going to St. Ives, Old Mother Hubbard, Ten Little Indians, Three Little Kittens, and The Old Woman who lived in a Shoe. Among the common stories are Jack and the Beanstalk, The Three Bears, and Jack the Giant Killer. Among the dramatized occupations are running a grocery store.

WRITING NUMBERS

1. Write in figures the numbers from 1 to 10.

2. Write in figures the numbers from 1 to 12, and then from 12 back to 1.

3. Write in figures the numbers from 0 to 12, and then from 12 back to 0.

4. Write in figures the number of letters in your first name and the number of letters in your last name.

5. Write in figures the number of letters in your teacher's last name.

6. Write in figures the number of words in this line.

7. Write in figures the number of cents in a dime.

8. How many fingers and thumbs have you on both hands? Write this number in figures.

9. Write in figures the number of doors in this room, and then write the number of windows.

10. Write in figures the number of desks in your row.

11. Write in figures the numbers which come just after 3, 9, 5, 7, 1, and 8 in counting from 0 to 12.

12. Write in figures the numbers which come just before 7, 6, 9, 5, 3, and 10 in counting from 0 to 12.

13. Write in figures the number which comes between 9 and 11 in counting.

The pupils should close their eyes and hear the teacher tap the desk, writing in figures the number of taps they hear. They should also close their eyes, touch a number of objects supplied or indicated by the teacher, such as fingers, pencils, or cubes, and then write the numbers.

II. ADDITION

PLAYING SCHOOL

All work oral

1. Let us play school. Mary is the teacher. She has 3 boys and 3 girls in her class. How many pupils has she?

2. Mary sends 2 boys and 2 girls to the board. How many pupils does she send to the board?

3. Mary asks for the sum of 2 and 3. How much is it? What do you mean by the sum of two numbers?

4. Mary writes $3+1$ on the board and asks Frank to read it. How should he read it?

5. Read these:

$2+4=6$ $\quad$ $3+3=6$ $\quad$ $5+1=6$

6. Add these:

5	1	1	2	1	1	1	1	6
1	4	6	1	7	1	8	0	1

7. Mary asks Frank how many desks there are in a row. He says there are 5. She asks him how many there are in two rows. How many are there?

If the class does not understand the words "add" and "sum" and the symbols + and =, these should be explained. The symbol + may be read either "and" or "plus."

Avoid formal definitions at this time.

The teacher will find sets of cards, each having a combination like those in Ex. 6, useful for drill, the set to be enlarged as the class advances.

Less written than oral work should be given at first, and pupils should be required to do the written as well as the oral work quickly. Loitering brings both inaccuracy and lack of interest.

SKIPPING THE ROPE

All work oral

1. These girls count 2 for each skip of the rope. They count "2, 4, 6," and so on. Count for four skips.

2. Count 2 for each skip of the rope to five skips.

3. Count 2 for each skip of the rope to six skips.

4. The girls swing the rope faster. Now they count 3 for each skip. Count for three skips.

5. Count 3 for each skip of the rope to four skips.

6. Ruth cannot jump very well, but she can add fast. Count 4 for each of her skips for three skips.

7. Count by 2's from 2 to 12.

8. Count by 3's from 3 to 12; by 4's from 4 to 12.

From time to time a certain amount of dramatized work should be introduced by the teacher, as suggested on page 2, but it should not be so extravagantly used as to leave no time for real number work.

THE STORY ON THE LAWN

All work oral

1. Rose is reading stories to 3 other girls and 3 boys on the lawn. How many children are there in all?

2. There are 4 pages in the first story and 5 pages in the next story. How many pages are there in the two stories? How many are 4 and 5?

3. There are 2 children on one side of Rose and 4 on the other side. To how many is Rose reading the stories?

4. Rose reads about 7 little fairies and 4 large fairies. How many fairies are there in all?

5. She reads about 3 large bears and 8 little bears. How many bears are there in all?

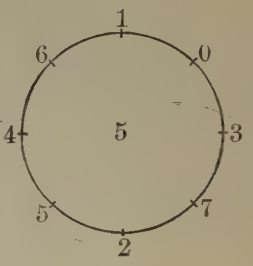
6. Rose is reading in a rose garden. There are 4 roses on one side of her and 3 on the other side. How many roses are there on both sides? How many are 4 and 3? How many are 3 and 4?

PLAYING NUMBER GAMES

All work oral

1. Our class played the game of Numbers on the Hoop. The teacher put this picture on the blackboard. As Ruth pointed to the numbers on the hoop, we added 5 to each. Add 5 to each of these numbers:

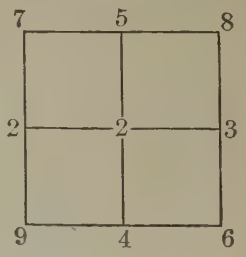
1 3 2 7 0 6 5 4



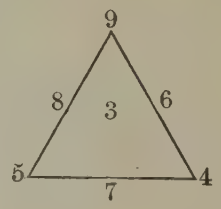
Change the number to be added and write the new number in the hoop, making a new game. The numbers must be chosen so that the sum, at this time, does not exceed 12. Similarly for Ex. 2 and other games.

2. We played Running the Square. The teacher put this picture on the blackboard. As Ben pointed to the numbers on the square, we ran around it with him and added 2 to each number. Add 2 to each of these numbers:

7 3 6 9 5 2 4 8
1 4 2 6 8 3 7 5



3. We also played Running the Triangle. The teacher put this picture on the blackboard, and we tried to see how fast we could run around it, adding each number to the one inside. Run around, beginning with 4. Run around, beginning with 9. Run around, beginning with 5.



III. SUBTRACTION

HELEN AND HER BLOCKS

Numbers 1 to 5, oral

1. Helen is counting her blocks. She has 7 blocks and takes away 3 blocks. How many blocks are left?

2. If Helen takes 4 blocks from 7 blocks, how many blocks are left?

3. How many blocks are 7 of these blocks less 3 of these blocks?

4. How many blocks are 7 of these blocks less 4 of these blocks?

5. If Helen takes 2 blocks from 7 blocks, how many blocks has she left?

Copy and subtract:

6.	7	7	7	7	7	8	10	10
	1	6	5	0	7	2	3	5
7.	8	9	9	8	8	9	11	12
	3	1	5	4	6	7	4	6

If the class does not understand the words "subtract" and "difference" and the symbol $-$, these should be explained. The symbol $-$ may be read either "less" or "minus." The relation of $2 + 5 = 7$ to $7 - 2 = 5$ and $7 - 5 = 2$ should be explained with objects.

The school should decide upon the method to be used in subtraction, and proceed accordingly. See page 248.

PLAYING STORE

Numbers 1 to 5, oral

1. Martha is buying apples from Jennie. If she buys 2 cents' worth, and gives Jennie 10 cents, how much change should she get?

2. If Martha buys 5 cents' worth of candy and gives Jennie 10 cents, how much change should Jennie pay her?

3. How much money should she pay Jennie for 2 pop-corn balls if they cost 2 cents each? What change should she get if she gives Jennie a 5-cent piece?

4. If Martha buys 3 apples, paying 1 cent for each, and a pop-corn ball for 2 cents, how much does she pay for all?

5. If Martha buys 2 apples at 1 cent each, 5 cents' worth of candy, and 4 cents' worth of pop-corn balls, how much does she pay for all?

Copy and subtract:

6.	8	9	8	9	10	11	12	12
	5	2	7	8	4	5	3	5
7.	8	9	8	9	10	11	11	12
	0	6	8	3	7	7	9	9

CLIMBING THE LADDER

All work oral

1. In school to-day we played the game of Climbing the Ladder. We climbed as fast as we could. When any one made a mistake he fell off. Climb the ladder in the picture. These numbers are $5-2$, $4-2$, $3-2$, $8-2$, $9-2$, $7-2$, and $6-2$. Tell the answers as fast as you can.

2. Tell the answers for $9-2$, $7-2$, $5-2$.

Climb these ladders as fast as you can, beginning at the foot:

3.	4.	5.	6.
$12-3$	$12-4$	$10-5$	$11-6$
$10-3$	$10-4$	$12-5$	$10-6$
$5-3$	$11-4$	$11-5$	$12-6$
$3-3$	$7-4$	$7-5$	$7-6$
$8-3$	$5-4$	$5-5$	$6-6$
$4-3$	$9-4$	$9-5$	$8-6$

WRITTEN REVIEW

Copy and subtract:

1.	5	6	7	8	9	10	11	12
	3	4	5	0	9	8	9	4
2.	6	7	4	5	8	10	11	12
	5	4	4	4	5	7	7	6
3.	5	8	9	7	6	10	11	12
	5	3	7	3	6	6	3	8
4.	7	6	5	9	8	10	11	12
	2	3	0	4	6	4	2	10

5. Copy these additions, putting the right number in place of each star:

3	*	4	*	6	10	12	*
*	8	*	5	6	*	*	11
7	9	9	8	*	12	12	12

6. Copy these subtractions, putting the right number in place of each star:

7	*	9	8	*	10	*	12
*	7	6	*	9	*	11	9
3	4	*	2	3	3	1	*

Copy these additions and subtractions, putting the right number in place of each star:

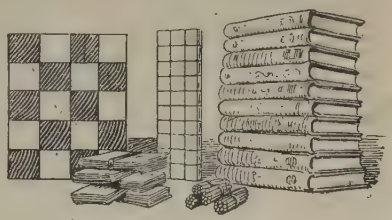
7. $4 + * = 9$.
8. $9 - * = 4$.
9. $7 + 3 = *$.
10. $10 - 3 = *$.
11. $5 + * = 10$.
12. $10 - * = 5$.

IV. COUNTING TO 100

READING NUMBERS

All work oral

1. How many books are there in the picture? If there were 10 more, how many would there be? What name do we give to two 10's?



2. How many blocks in the black-and-white pile? How many 10's in this pile?

3. There are 3 columns of smaller blocks. How many blocks in each column? How many blocks in all the columns? What name do we give to 3 tens?

4. There are 4 bundles of splints in the picture, 10 in each bundle. How many splints in all? What name do we give to 4 tens?

5. There are 5 packages of envelopes in the picture, 10 in each package. How many envelopes are there? What name do we give to 5 tens?

6. Read these numbers:

20	30	40	60	10
70	90	80	50	100

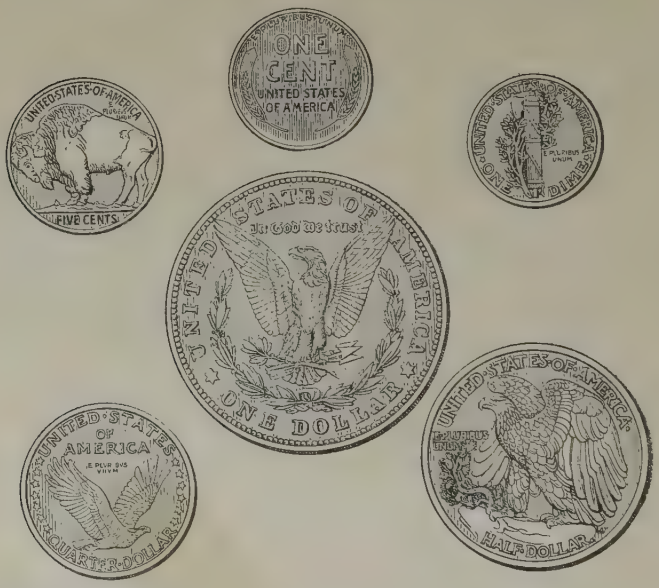
7. How many tens are there in 30? in 40? in 80?

8. What name should we give to 8 tens? to 7 tens? to 9 tens? to 6 tens? to 5 tens? to 10 tens?

The teacher should explain, if necessary, that 10 tens make 100.

MONEY

Here are pictures of six of our common coins:



Read and learn:

5 cents = 1 nickel
10 cents = 1 dime
100 cents = 1 dollar

We write ¢, c., or ct. for cent or cents, and $ for dollar or dollars; thus

3¢ means 3 cents,
25¢ means 25 cents,
$5 means 5 dollars,
and $10 means 10 dollars.

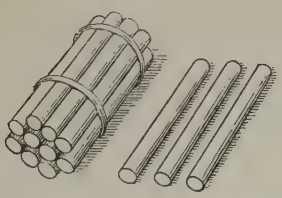
READING AND WRITING NUMBERS

Numbers 1 to 6, oral

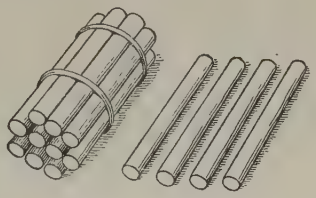
1. If you call 2 tens *twenty* and write it 20, and if you call 3 tens *thirty* and write it 30, what should you call 4 tens, 5 tens, 6 tens, 7 tens, 8 tens, and 9 tens, and how should you write them?

2. Read these numbers: 80, 70, 40, 60, 30, 90, 100.

3. Count from 1 to 10; then by 10's to 100.



$10 + 3 = 13$



$10 + 4 = 14$

4. If *thirteen* means *three-ten*, what does *fourteen* mean?

5. If we write 13 for thirteen, what do we write for fourteen? for fifteen? for sixteen?

6. In the number 13 we say that there are 3 units and 1 ten. In the number 14 how many units are there? How many tens are there?

Write in figures:

7. Fifteen.	11. Eight.	15. Ninety.
8. Twelve.	12. Eighty.	16. Nineteen.
9. Sixty.	13. Eighteen.	17. Seventy.
10. Sixteen.	14. Eleven.	18. Seventeen.

READING AND WRITING NUMBERS

Numbers 1 to 8, oral

1. 10 splints and 3 splints are how many splints?
2. 20 splints and 4 splints are how many splints?

3. Read the numbers 13 and 24.
4. Point to 32 splints in the picture; to 48 splints.
5. If 21 means $20 + 1$, or 2 tens and 1 unit, what does 43 mean and how is it read?
6. Read each of these numbers and explain the meaning as in Ex. 5: 63, 74, 85, 96, 70.
7. What day of the month is this?
8. What is the second month of the year?

The above is suggestive of the oral work that should be given to fix the idea of numbers like 37 and to make clear the simple ordinal numbers "first," "second," "third," and so on.

Write in figures:

9. Thirty-one. 10. Fifty-two. 11. Sixty-six.

Write in words:

12. 33. 13. 49. 14. 94. 15. 19. 16. 90.

Write the number that, in counting, comes just before:

17. 20. 18. 39. 19. 55. 20. 70. 21. 100.

V. ADDITION

PLAYING STORE

Numbers 1 to 5, oral

1. The class played store. Frank bought a pencil for 5¢ and some paper for 10¢. How much did he pay for both the pencil and the paper?

2. Fred bought a pencil for 5¢ and a notebook for 20¢. How much did he pay for both?

3. Kate bought an eraser for 8¢ and a ruler for 20¢. How much did she pay for both?

4. Mollie bought some colored pencils for 10¢, and a ruler for 10¢. How much did she pay for them all?

5. Make up problems, using these prices:

Bottle of ink, 10¢	Pad of paper, 8¢ or 10¢
Penholder, 5¢	Ruler, 10¢ or 15¢
Pencil, 5¢, 8¢, or 10¢	Box of toy money, 25¢
Mucilage, 5¢	Game of letters, 20¢

Copy, add, and make a problem about each:

6.	3	7	3	9	4	7	4	9
	6	3	8	3	6	4	8	4
7.	5	7	5	9	6	8	6	7
	6	5	8	5	7	6	9	8
8.	3	4	5	3	6	4	3	5
	3	5	9	5	8	7	9	5

EARNING MONEY

Numbers 1 to 5, oral

1. If John earned 8¢ on Monday and 7¢ on Tuesday, how much did he earn in the two days?

2. Fred has 9¢ and he earns 8¢ more. How many cents does he then have?

3. Kate has 12¢ and she earns 7¢ more. How many cents does she then have?

4. A man has $4 and he earns $10 more. How much money does he then have?

5. If you earn 9¢ to-day and 8¢ to-morrow, how much do you earn in the two days?

6. A man has $75 in the bank. He earns $4 more and puts it in the bank. How much does he then have there?

Copy and add, making a problem about any three:

7. 3 / 5	11. 4 / 4	15. 6 / 3	19. 9 / 1	23. 17 / 2	27. 56 / 3
8. 13 / 5	12. 14 / 4	16. 16 / 3	20. 19 / 1	24. 18 / 1	28. 52 / 4
9. 5 / 3	13. 4 / 5	17. 7 / 2	21. 8 / 2	25. 29 / 1	29. 61 / 7
10. 15 / 3	14. 14 / 5	18. 17 / 2	22. 18 / 2	26. 38 / 2	30. 74 / 5

ADDITION TABLE

1 + 2 = 3	1 + 3 = 4	1 + 4 = 5	1 + 5 = 6
2 + 2 = 4	2 + 3 = 5	2 + 4 = 6	2 + 5 = 7
3 + 2 = 5	3 + 3 = 6	3 + 4 = 7	3 + 5 = 8
4 + 2 = 6	4 + 3 = 7	4 + 4 = 8	4 + 5 = 9
5 + 2 = 7	5 + 3 = 8	5 + 4 = 9	5 + 5 = 10
6 + 2 = 8	6 + 3 = 9	6 + 4 = 10	6 + 5 = 11
7 + 2 = 9	7 + 3 = 10	7 + 4 = 11	7 + 5 = 12
8 + 2 = 10	8 + 3 = 11	8 + 4 = 12	8 + 5 = 13
9 + 2 = 11	9 + 3 = 12	9 + 4 = 13	9 + 5 = 14
10 + 2 = 12	10 + 3 = 13	10 + 4 = 14	10 + 5 = 15
1 + 6 = 7	1 + 7 = 8	1 + 8 = 9	1 + 9 = 10
2 + 6 = 8	2 + 7 = 9	2 + 8 = 10	2 + 9 = 11
3 + 6 = 9	3 + 7 = 10	3 + 8 = 11	3 + 9 = 12
4 + 6 = 10	4 + 7 = 11	4 + 8 = 12	4 + 9 = 13
5 + 6 = 11	5 + 7 = 12	5 + 8 = 13	5 + 9 = 14
6 + 6 = 12	6 + 7 = 13	6 + 8 = 14	6 + 9 = 15
7 + 6 = 13	7 + 7 = 14	7 + 8 = 15	7 + 9 = 16
8 + 6 = 14	8 + 7 = 15	8 + 8 = 16	8 + 9 = 17
9 + 6 = 15	9 + 7 = 16	9 + 8 = 17	9 + 9 = 18
10 + 6 = 16	10 + 7 = 17	10 + 8 = 18	10 + 9 = 19

The pupil is already familiar with these number facts. There is, however, an advantage in reciting a table, as well as in being drilled upon the number combinations selected at random. The latter drill is provided on the next page and in the frequent reviews.

FUNDAMENTAL COMBINATIONS

Add the following:

1.	9	5	0	4	3	2	0	6	5	3
	5	6	2	7	1	5	3	6	7	3
2.	8	6	4	7	7	5	5	3	8	2
	6	7	4	7	6	8	9	4	1	0
3.	5	6	7	4	6	1	2	7	2	0
	1	5	0	9	9	2	4	9	3	9
4.	3	8	0	4	9	8	1	3	2	0
	0	9	5	1	9	0	3	5	1	0
5.	5	8	2	9	1	1	0	9	6	3
	0	8	2	6	4	5	6	8	0	9
6.	5	7	3	0	1	9	1	6	2	7
	4	8	6	7	1	7	6	4	7	1
7.	3	8	9	0	6	8	7	7	4	2
	2	5	3	4	8	3	5	4	2	8
8.	4	9	5	4	6	0	2	5	4	3
	0	0	5	6	2	8	6	2	3	7
9.	1	6	7	7	8	1	5	4	8	2
	0	1	3	2	4	7	3	5	7	9
10.	9	9	4	0	6	1	8	1	9	3
	2	4	8	1	3	9	2	8	1	8

All the fundamental combinations in addition are given on this page for oral drill, and hence the page should be reviewed frequently.

TROUBLESOME GROUPS

All work oral

1. Which number do you find easiest to add to another number? Give four examples.

2. Which number do you find hardest to add to another number? Give four examples.

3. Which two numbers of one figure each do you find hardest to add?

The answers to these questions will reveal the "troublesome" groups, and these should receive attention until they are as familiar as the "easy" groups. In general, the combinations given below are the ones that trouble children most, the most difficult ones being repeated several times.

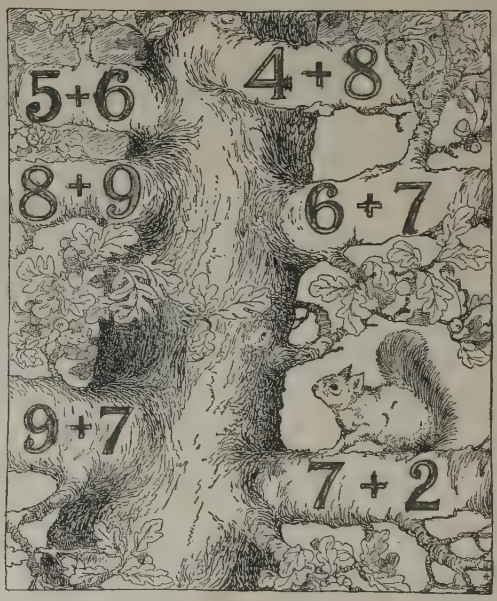
Add the following:

4.	8	6	5	5	7	8	7	5	2	7
	7	5	8	7	8	6	5	4	9	7
5.	7	6	8	8	8	7	3	5	8	7
	5	8	5	7	4	8	8	3	8	6
6.	5	8	8	5	8	6	5	4	8	9
	7	8	7	8	6	7	6	5	3	9
7.	4	8	5	6	8	6	7	3	6	7
	7	7	7	5	8	6	8	5	7	7
8.	5	6	7	7	7	7	5	9	8	6
	6	8	5	6	8	4	9	2	7	7
9.	6	3	9	4	5	9	7	3	9	9
	6	9	4	8	8	9	7	8	5	8

THE GAME OF NIMBLE SQUIRREL

All work oral

1. The game we played to-day was Nimble Squirrel. The squirrel jumped from branch to branch and told the sums of the numbers. When he could not give the answers quickly he fell off. Be the nimble squirrel and name all the answers as quickly as you can, taking care not to fall off:



7 + 2	5 + 6
6 + 7	8 + 9
4 + 8	9 + 7

Beginning at the bottom of each column, tell these sums as you jump from branch to branch:

2.	**3.**	**4.**	**5.**	**6.**
5 + 2	9 + 3	8 + 4	4 + 6	5 + 8
3 + 2	6 + 3	6 + 4	8 + 5	7 + 6
8 + 2	2 + 3	4 + 4	5 + 3	3 + 4
6 + 2	8 + 3	7 + 4	4 + 2	5 + 5
9 + 2	4 + 3	5 + 4	7 + 1	3 + 9
7 + 2	5 + 3	9 + 4	3 + 8	4 + 7

Column Addition. Let us suppose that there are 9 pencils, 5 pencils, and 2 pencils in use in your class. How many pencils are there in all?

Arrange the numbers in a column, and then begin with the lowest figure to add. Here we have $2 + 5 = 7$, and $7 + 9 = 16$. We see that 16 is the sum, and we write 16 below the line.

9
5
2
16

We make sure that the work is right by adding from the top down, thus: $9 + 5 = 14$, and $14 + 2 = 16$. We then say that we have *checked* the work, because the two sums are the same.

We see that there are 16 pencils in the class.

Teach the child to read a column as he reads a word, as far as this is possible. As he looks at this column he should think "2, 7, 16," thinking no other words.

COLUMN ADDITION

Numbers 1 to 15, oral

Add the following:

1. 1	4. 4	7. 6	10. 9	13. 3	16. 3	19. 7
2	4	1	1	3	8	6
2	0	1	1	3	2	4
2. 5	5. 6	8. 9	11. 2	14. 8	17. 7	20. 9
0	2	1	4	1	8	4
4	2	0	3	1	2	6
3. 4	6. 9	9. 5	12. 8	15. 5	18. 6	21. 4
2	0	1	2	2	6	3
1	0	2	0	3	4	7

THE GAME OF NUMBER SPRINTERS

All work oral

1. To-day we played the game of Number Sprinters. See how much of a number sprinter you are, by telling the sums in the picture as fast as you can.

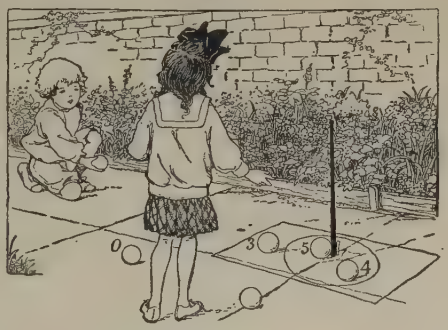
Run over these courses, and time yourself:

2.	1	3	3	2	2	2	3	4	1	3
	2	2	2	2	3	4	4	4	2	1
	5	1	2	4	4	4	4	4	9	5
3.	3	3	2	2	4	4	4	5	5	5
	2	3	2	4	3	4	5	4	6	3
	5	5	5	5	5	5	5	6	5	7
4.	3	3	3	5	6	3	1	1	1	3
	3	4	2	2	3	7	7	8	1	1
	7	7	7	8	7	7	8	8	9	9

KEEPING SCORE

All work oral

1. John and Kate played this number game. If a ball, when it stops, touches the stick, it counts 5; if it stops in the circle, it counts 4; if it stops in the oblong, it counts 3; and if it stops anywhere else, it counts 0. These were the scores. Who won the game?



John,	0	0	0	3	0	3	0	0	3	0	0	3
Kate,	0	0	0	0	5	5	5	0	0	0	4	0

2. Kate, John, and Fred played this game. If a bag strikes the ladder, it counts 0. These were the three scores:

Kate,	3	2	0	0	4	1
John,	1	1	3	2	0	2
Fred,	4	3	2	0	0	2

Who won the game?

3. The next time they played, these were the scores:

Kate,	2	3	2	1	3	1
John,	4	0	1	3	4	1
Fred,	3	3	0	0	4	4

Who won the game? Who had the lowest score of all?

Column Addition. If you read 25 pages of a book on Monday and 31 pages on Tuesday, how many pages did you read on both days? We see that we must add 25 and 31 to find the answer.

$$\begin{array}{r} 31 \\ 25 \\ \hline 56 \end{array}$$

We write the numbers one under the other, units under units and tens under tens.

Adding the units, we find that the sum is 6, and write the 6 below the line, in units' column.

Adding the tens, we find that the sum is 5, and write the 5 below the line, in tens' column.

The sum is 56, and so you have read 56 pages in all.

COLUMN ADDITION

1. One basket contains 11 oranges and another contains 24. How many oranges are there in both?

2. There are 44 trees in one park and 34 in another. How many trees are there in both parks?

3. In one class there are 24 pupils and in another class there are 23. How many are there in both classes?

4. One boy in our class has 35 marbles and another boy has 42. How many marbles have the two boys together?

Copy, add, and make a problem about any three:

5. 30	7. 60	9. 30	11. 70	13. 78	15. 43
40	26	67	28	21	54
6. 38	8. 62	10. 32	12. 71	14. 51	16. 36
41	26	67	28	16	23

VI. SUBTRACTION

Column Subtraction. A book has 78 pages and we have read 41 pages. How many pages have we left to read?

We see that we must subtract 41 from 78.

We write the smaller number below the larger number. We first think "$8 - 1 = 7$," and write the 7 below the line, under units. We then think "$7 - 4 = 3$," and write the 3 below the line, under tens.

$$\begin{array}{r} 78 \\ 41 \\ \hline 37 \end{array}$$

The result is 37, and so we have 37 pages left to read.

To make sure that the work is correct, that is, to check the work, we add 37 and 41, the result being 78.

As to the method of subtraction, the teacher should read page 248.

If oral work with two-figure numbers is taken, it should, at present, be confined to simple cases like those given below.

COLUMN SUBTRACTION

All work oral

1. If you have 10¢ and pay 4¢ for a pencil, how much have you left?

2. If you have 20¢ and pay 15¢ for some paper, how much have you left?

3. If you have 16 oranges and sell 5 of them, how many oranges have you left?

4. Subtract rapidly:

20	40	50	75	75	86	98
10	20	10	70	20	20	30

SUBTRACTING NUMBERS

1. If Frank has 30 marbles, how many more marbles must he get so as to have 45 in all?

2. If George has 35 marbles, how many more marbles must he get so as to have 45 in all?

3. If your score in a game is 48 and mine is 35, how much are you ahead of me?

Copy the following and subtract:

4. 78 − 63	**11.** 78 − 36	**18.** 85 − 31	**25.** 76 − 34	**32.** 56 − 21	**39.** 83 − 52
5. 72 − 22	**12.** 98 − 36	**19.** 75 − 51	**26.** 53 − 12	**33.** 61 − 31	**40.** 89 − 18
6. 88 − 32	**13.** 79 − 21	**20.** 74 − 30	**27.** 66 − 22	**34.** 78 − 23	**41.** 84 − 30
7. 78 − 24	**14.** 79 − 40	**21.** 89 − 26	**28.** 96 − 42	**35.** 84 − 40	**42.** 77 − 25
8. 53 − 31	**15.** 84 − 50	**22.** 74 − 51	**29.** 77 − 33	**36.** 84 − 61	**43.** 79 − 34
9. 65 − 14	**16.** 73 − 20	**23.** 50 − 30	**30.** 28 − 28	**37.** 78 − 11	**44.** 56 − 30
10. 82 − 10	**17.** 64 − 11	**24.** 90 − 0	**31.** 75 − 60	**38.** 87 − 30	**45.** 64 − 12

ORAL REVIEW DRILL

Add each of the numbers 2, 3, 4, 5, in turn, to each of the following numbers:

1.	31	51	81	21	71	41	61	91	11
2.	42	82	22	72	52	12	92	32	62
3.	83	33	73	93	13	63	43	23	53
4.	64	44	74	94	34	84	14	54	24

Add each of the numbers 6 and 7, in turn, to each of the following numbers:

5.	19	11	31	61	51	71	21	81	41
6.	37	10	12	52	22	30	42	82	50
7.	48	80	32	20	72	92	60	40	62

Subtract each of the numbers 2, 3, 4, 5, in turn, from each of the following numbers:

8.	11	13	65	15	45	25	35	55	75
9.	12	14	86	56	36	66	16	76	26
10.	17	47	29	67	78	37	89	57	99

Subtract each of the numbers 6 and 7, in turn, from each of the following numbers:

11.	11	13	15	88	48	98	68	28	18
12.	12	14	16	69	29	99	97	39	59

In exercises of this nature it is not expected that teachers will require all of the work. As soon as the pupils show themselves proficient in the additions and subtractions they should pass to the next topic.

PROBLEMS ABOUT THE STORE

1. Charles went to the store and bought a book for 25¢ and some paper for 10¢. How much did he pay for both?

2. Maud bought a book for 35¢ and a ruler for 10¢. How much did she pay for both?

3. Frank bought a box of crayons for 30¢ and a notebook for 20¢. How much did he pay for both?

4. Irene's mother sent her to buy some cakes. Irene bought 16 of one kind and 12 of another kind. How many cakes did she buy in all?

5. Fred had 50¢. He bought a bottle of ink for 10¢. How much had he left?

6. The teacher bought a box of colored crayons for 40¢. She gave the dealer 50¢. How much money did he give back to her?

7. Rob bought some candy for 5¢, an apple for 2¢, and an orange for 6¢. How much did he pay for all?

8. At our store they sell colored pencils for 15¢ a box. If I buy a box and give the dealer 25¢, how much money does he give back to me?

9. Make and solve a problem about buying things at a store, using some of these prices:

Pad of paper, 15¢	Arithmetic, 30¢
Notebook, 20¢	Pencil, 5¢ or 10¢
Ruler, 15¢ or 20¢	Eraser, 5¢ or 8¢
Bottle of black ink, 18¢	Pens, 12 for 10¢

10. Make and solve another problem as in Ex. 9.

VII. MEASURES AND FRACTIONS

MEASURING LENGTHS

1. Frank measures this plant. It is more than 1 foot high. With a ruler draw on the blackboard a line that is 1 foot long.

2. This line is 1 inch long: ———. Draw on paper a line that is 2 inches long.

3. The plant that Frank is measuring is 1 foot 4 inches high. Draw on the blackboard a line that is 1 foot 4 inches long.

4. We write ft. for foot or feet, in. for inch or inches, and 1 ft. 4 in. for 1 foot 4 inches. Draw on the blackboard a line 1 ft. 6 in. long.

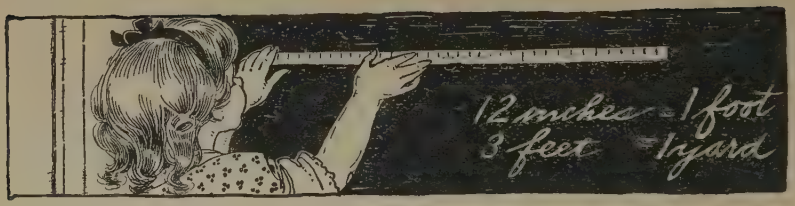
Draw on the blackboard lines of these lengths:

5. 1 ft. 1 in.
6. 2 ft. 2 in.
7. 2 ft. 9 in.
8. 1 ft. 11 in.
9. 2 ft. 10 in.
10. 3 ft. 6 in.

This work is already familiar to the pupils, but a brief review is valuable. Work in measuring means little unless the children actually do it themselves. They should estimate short lengths and then test their accuracy by using the ruler. The idea of greater and less enters into all measurements, and the teacher should emphasize the notion of comparison.

Such work should be a combination of oral questioning, of measuring, and of blackboard exercise.

The advantage of relating measures to the study of fractions will be apparent to the teacher. It gives concreteness to the work with fractions.



MEASURING LENGTHS

1. What measure is Kate using in this picture?

2. How many feet are there in 1 yard?

3. We write yd. for yard or yards. How many feet are there in 2 yd.?

4. How many inches are there in 1 ft.?

5. By adding on the blackboard, or by looking at the yard measure, find the number of inches in 1 yd.

6. How many feet are there in 1 yd. 1 ft.?

7. Read and learn:

12 inches = 1 foot
3 feet = 1 yard

Write the number of feet in these lengths:

8. 2 yd. **9.** 3 yd. **10.** 1 yd. 2 ft. **11.** 2 yd. 1 ft.

Write the number of inches in these lengths:

12. 2 ft. **13.** 3 ft. **14.** 1 ft. 2 in. **15.** 2 ft. 4 in.

Such exercises as this and the one on page 31 should be treated as combinations of oral and written work and of measuring.

A yardstick and a ruler divided into inches, half inches, and quarter inches are desirable for this work.

MEASURING EXERCISE

1. Measure the width of the room in yards, omitting parts of a yard. Measure this distance in feet.

2. Look at the foot rule. Point to 1 in. on the rule; point to 4 in.; to 6 in.; to 8 in.

3. Draw a line 1 ft. long and divide it into inches. How many inches are 6 in. and 6 in.?

4. How many inches are there in 2 ft. 1 in.?

5. Point to 3 in. How many inches are there in 1 ft. less 3 in.? How many inches are there in 1 ft. 3 in.?

6. Point to 4 in. How many inches are there in 1 ft. less 4 in.? How many inches are there in 1 ft. 4 in.?

7. Draw a line that you think is 1 ft. long. Measure it.

8. Draw a line that you think is 6 in. long. Measure it.

9. Is the edge of your desk more than 1 ft. long or is it less than 1 ft. long? Measure it.

10. Is your desk more than 1 ft. high or is it less than 1 ft. high? Measure it.

11. Cut a piece of string that you think is 1 yd. long.

12. Draw a line that you think is 1 in. long. Measure it.

13. How many inches are there in 1 ft. less 5 in.?

14. How many inches are there in 1 ft. less 8 in.?

15. Draw a line that you think is 24 in. long. Measure it.

The children should be given much practice of this kind, but not necessarily the exact problems stated above. Such work may well be given with reference to objects in the schoolroom. This page should be treated like pages 31 and 32.

ONE HALF OF AN OBJECT

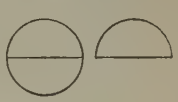
1. One of these apples has been cut into two equal parts. Each of these parts is called one half of the apple. The apple has how many halves?

2. One half is written like this: $\frac{1}{2}$. How do you read $\frac{1}{2}$ in.? $\frac{1}{2}$ ft.? $\frac{1}{2}$ yd.?

3. Draw on paper a line 1 in. long and divide it into two equal parts. How long is each part?

4. Draw on paper a line 2 in. long and mark off $\frac{1}{2}$ of it.

5. Here is a circle and $\frac{1}{2}$ of a circle. We write one and a half like this: $1\frac{1}{2}$. Draw a line $1\frac{1}{2}$ in. long.



6. Draw on paper a line $2\frac{1}{2}$ in. long.

7. We write two halves like this: $\frac{2}{2}$. Draw on paper a line $\frac{2}{2}$ in. long. How many inches long is it?

8. Draw on the blackboard a line $\frac{1}{2}$ yd. long.

Call the attention of the pupils to the fact that we may speak of half of an object, half of a group, and half as large. Thus we may take half of a piece of paper, take half of 6 dots, or take a stick that is half as long as another stick. Paper folding and paper cutting may be used to advantage in explaining the idea of half of an object.

9. How many halves of an inch are there in 1 in.?

Measure the number of halves of a foot in:

10. 1 ft. **11.** $\frac{2}{2}$ ft. **12.** $1\frac{1}{2}$ ft. **13.** 2 ft. **14.** $2\frac{1}{2}$ ft.

Write the number of halves of an inch in:

15. 1 in. **16.** $\frac{2}{2}$ in. **17.** $1\frac{1}{2}$ in. **18.** 2 in. **19.** $2\frac{1}{2}$ in.

ONE HALF OF A GROUP

1. How many rabbits are there in this picture? If we take $\frac{1}{2}$ of them away, we take how many rabbits away?

2. Half of 6 dots are how many dots?

3. Half of 6¢ are how many cents?

4. Half of 8 marks are how many marks?

5. Half of $8 are how many dollars?

6. Half of 10 stars are how many stars?

7. Make twelve straight marks on the blackboard. How many marks are $\frac{1}{2}$ of 12 marks?

8. Make 16 small stars on the blackboard. How many stars are $\frac{1}{2}$ of 16 stars?

9. Make 20 large dots on the blackboard. How many dots are $\frac{1}{2}$ of 20 dots?

10. In a class of 20 children, half are boys. How many boys are there?

11. In a class of 24 children, half are girls. Count $\frac{1}{2}$ of 24 marks and so find the number of girls.

As with all beginning exercises with measures and fractions, this page should be treated as a combination of oral and blackboard work.

It should be stated that there are 50¢ in half of $1, preferably by asking the question and letting some pupil answer it.

HALF AS LARGE

1. Draw on the blackboard a line 4 in. long, and then draw a line that is half as long.

2. Draw a line that is 6 in. long, and then draw a line that is half as long.

3. Draw a line 1 yd. long, and then draw a line that is half as long. Measure this line in feet; in inches.

4. Kate is 8 years old. She has a little sister who is half as old. How old is Kate's sister?

5. A rosebush is 10 ft. high and another bush is half as high. How high is the shorter bush?

6. A line that is 4 in. long is what part as long as a line that is 8 in. long?

7. A piece of cloth 6 yd. long is what part as long as a piece that is 12 yd. long?

8. Draw on the blackboard a rectangle that is 10 in. long and half as wide.

9. Draw on the blackboard a rectangle that is 1 ft. long and half as wide.

10. A rectangle is half as wide as it is long. It is 8 in. wide. Draw the rectangle on the blackboard.

11. Draw on the blackboard a line 2 ft. long, and then draw a line that is half as long.

If a pupil does not know the meaning of the word "rectangle," he should be told and the figure should be drawn on the blackboard. Rectangles in the room should then be pointed out by the class. All terms that are not familiar should be treated in the same way.

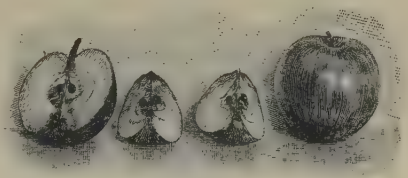
ONE FOURTH OF AN OBJECT

1. This square has been cut into four equal parts. Each of these parts is called one fourth, or one quarter, of the square. We see from this that the square has how many fourths?

$\frac{1}{4}$	$\frac{1}{4}$
$\frac{1}{4}$	$\frac{1}{4}$

2. One fourth, or one quarter, is written like this: $\frac{1}{4}$. How do you read $\frac{1}{4}$ in.? $\frac{1}{4}$ ft.? $\frac{1}{4}$ yd.?

3. One of these apples has been cut into parts. Which part is $\frac{1}{2}$ of the apple? Which part is $\frac{1}{4}$ of the apple?



4. Which is larger, $\frac{1}{2}$ of an apple or $\frac{1}{4}$ of the same apple?

5. How many fourths are equal to $\frac{1}{2}$?

6. Draw a line 1 in. long and divide it into fourths.

7. Three fourths, or three quarters, is written in this way: $\frac{3}{4}$. Draw a line $\frac{3}{4}$ in. long.

8. One inch and one fourth of an inch is written $1\frac{1}{4}$ in. and read "$1\frac{1}{4}$ inches." Draw a line $1\frac{1}{4}$ in. long.

9. We write four fourths like this: $\frac{4}{4}$. Draw a line $\frac{4}{4}$ in. long. How many inches long is it?

10. A line 1 in. long is $\frac{1}{4}$ of a line that is how many inches long?

11. How many inches are 9 in. + 9 in. + 9 in. + 9 in.? Then 9 in. is $\frac{1}{4}$ of how many inches?

12. How many inches are there in $\frac{1}{4}$ yd.?

ONE FOURTH

1. Here are 4 dots. How many dots are $\frac{1}{4}$ of 4 dots?

2. If you have 4 apples and give away $\frac{1}{4}$ of them, how many apples do you give away?

3. How many oranges are $\frac{1}{4}$ of 4 oranges?

4. Here are 8 dots. How many dots are $\frac{1}{4}$ of 8 dots?

5. How many dots are $\frac{3}{4}$ of 8 dots?

6. If you have 8 marbles and lose $\frac{1}{4}$ of them, how many marbles do you lose?

7. How many dots are there in $\frac{1}{2}$ of $\frac{1}{2}$ of 8 dots?

8. Draw a line 4 in. long; draw one that is $\frac{1}{4}$ as long; draw one that is $\frac{1}{2}$ as long.

9. Measure the length of your desk in inches to the nearest quarter of an inch.

10. Measure the width of your desk as in Ex. 9.

11. A line that is 3 in. long is $\frac{1}{4}$ of a line that is how many inches long?

12. Draw a line that is $\frac{1}{2}$ of $\frac{1}{2}$ ft. long. Its length is what part of 1 ft.?

13. How many cents are there in a quarter of a dollar? in a half dollar?

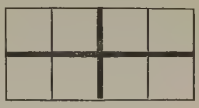
If any pupil does not know the answer to Ex. 13, the teacher should ask the class to give it. Most of the pupils by this time know the answer, the half dollar having already been mentioned on page 35.

Use paper folding, paper cutting, and drawing until the idea of one fourth of an object is clearly understood. Similarly, illustrate one fourth of a group and one fourth as large. Combine oral and written work as above, and relate it to interesting school and home measurements.

REVIEW OF FRACTIONS

Numbers 1 to 14, oral

1. Point to $\frac{1}{4}$ of these squares. How many squares are there in $\frac{1}{4}$ of 8 squares?



2. Show that $\frac{1}{2}$ of this rectangle is the same as $\frac{2}{4}$ of the rectangle.

3. Show that $\frac{4}{4}$ of the rectangle is the same as the whole rectangle.

4. Point to the upper $\frac{1}{2}$ of the 8 small squares in the rectangle; to the lower $\frac{1}{2}$; to the left-hand $\frac{1}{2}$; to the right-hand $\frac{1}{2}$. In each case, $\frac{1}{2}$ of 8 is how many?

5. How many marks are $\frac{1}{2}$ of 12 marks? |||||| ||||||

Read and learn:

6. $\frac{1}{2}$ of 2 is 1.

7. $\frac{1}{2}$ of 4 is 2.

8. $\frac{1}{4}$ of 4 is 1.

9. $\frac{1}{2}$ of 6 is 3.

10. $\frac{1}{2}$ of 8 is 4.

11. $\frac{1}{4}$ of 8 is 2.

12. $\frac{1}{2}$ of 10 is 5.

13. $\frac{1}{2}$ of 12 is 6.

14. $\frac{1}{4}$ of 12 is 3.

15. If John has 12¢ and Rob has $\frac{1}{2}$ as much, how much money does Rob have?

16. If a boy 10 years old has a sister who is $\frac{1}{2}$ as old, how old is the sister?

17. If a man is 6 ft. tall and his son is $\frac{1}{2}$ as tall, how tall is his son?

18. How many inches are there in $\frac{1}{4}$ of a foot?

19. How many inches are there in $\frac{1}{2}$ of a foot?

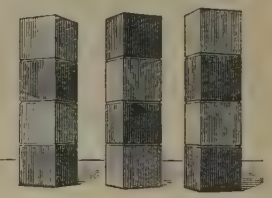
20. Draw a line 8 in. long; draw one that is $\frac{1}{2}$ as long; draw one that is $\frac{1}{4}$ as long.

THE DOZEN

Numbers 1 to 7, oral

1. We call 12 things a dozen, and we write 1 doz. for one dozen. How many cubes make 1 doz. cubes?

2. There are 12 in. in a foot. What other name can you give to 1 doz. inches?



3. Name some things that are sold by the dozen. Can you tell the price of 1 doz. of each?

4. How many cubes make a half dozen cubes? How many cubes make a quarter of a dozen cubes? Point to the cubes in giving each answer.

5. How many fours do you see in a dozen? How many threes? How many twos? How many sixes? Point to the cubes in giving each answer.

6. A hen sits on a dozen eggs and hatches all but two. How many chickens are hatched?

7. When eggs are worth 40¢ a dozen, how much does a half dozen cost?

Copy, putting the right number in place of each star:

8. $\frac{1}{2}$ of 12 = *.	**11.** $\frac{1}{4}$ of 12 = *.	**14.** $\frac{3}{4}$ of 12 = *.
9. $\frac{1}{2}$ of * = 6.	**12.** $\frac{1}{4}$ of * = 3.	**15.** $\frac{3}{4}$ of * = 9.
10. * of 12 = 6.	**13.** * of 12 = 3.	**16.** * of 12 = 9.

Show the pupils how to find $\frac{3}{4}$ of 12 from $\frac{1}{4}$ of 12, thus anticipating further simple work in fractional parts.

PINT AND QUART

All work oral

1. How many pints of milk make 1 quart of milk?

2. Which is the pint measure in the picture? Which is the quart measure? Which is the larger measure?

3. How many times must you pour the full pint into the quart measure to fill it?

4. Read and learn:

2 pints = 1 quart

5. We write qt. for quart or quarts, and pt. for pint or pints. 1 pt. is what part of 1 qt.?

6. Name two things that are sold by the quart and two that are sold by the pint.

7. How much does a quart of milk cost where we live? How much does a pint of milk cost?

8. If I have a quart of cream and a pint of cream, how many pints of cream do I have?

The actual measures should, if possible, be used in class.

WEIGHT

All work oral

1. Margaret is showing the other children how to weigh a book on the scales. She places a 1-pound weight and a $\frac{1}{4}$-pound weight in one pan to balance the book. How much do the children find that the book weighs?

2. We write lb. for pound or pounds. Thus, 2 lb. means 2 pounds. What does $2\frac{1}{2}$ lb. mean?

3. Add 3 lb., 10 lb., 1 lb., 1 lb., and 1 lb.

4. Add 6 lb., 4 lb., 3 lb., 1 lb., 1 lb., and 2 lb.

5. Find $\frac{1}{4}$ of 4 lb., $\frac{1}{2}$ of 6 lb., $\frac{1}{2}$ of 8 lb., and $\frac{1}{2}$ of 12 lb.

6. If one of your books weighs $\frac{1}{2}$ lb., another $\frac{1}{4}$ lb., and a third $\frac{1}{4}$ lb., how much do all three books weigh?

It is desirable that the children should weigh various objects, using the pound, half pound, and quarter pound.

PLAYING STORE

Numbers 1 to 4, oral

1. Isabel is the storekeeper to-day. Mary wants 8 pieces of candy at 2¢ each. How much must she pay?

2. She wants 3 pop-corn balls at 3¢ each. How much must she pay?

3. If Mary buys 4 apples at 3¢ each, how much will they cost?

4. A box of crackers costs 8¢. Mary buys 2 boxes. How much must she pay?

5. How many crackers in a box of 2 doz. crackers?

6. If Mary buys $1\frac{1}{2}$ doz. bananas, how many bananas does she buy?

7. Mary buys $1\frac{1}{4}$ doz. oranges. How many oranges does she buy?

8. Write another problem about Mary at the store, and solve it.

It is desirable to anticipate multiplication occasionally, as in Exs. 1–4.

PROBLEMS WITHOUT NUMBERS

1. If Nora has some eggs in her basket and buys some more eggs, how do you find the number of eggs that she then has?

2. If Nora knows the price of a dozen eggs and also of a half-dozen eggs, how does she find the price of a dozen and a half?

3. If Nora knows the price of one grapefruit, how does she find the price of two or of three grapefruits?

4. If Nora buys a pineapple and some oranges, how does she find how much she must pay for them?

5. If Nora finds that the prices of two pineapples are not the same, how does she find how much cheaper one pineapple is than the other?

6. If Nora knows the price of 1 doz. oranges of one kind and the price of 1 doz. oranges of a better kind, how does she find how much more she must pay for 1 doz. of the better kind than for 1 doz. of the poorer kind?

VIII. MINIMUM ESSENTIALS

WRITTEN EXERCISE

1. Write in figures: seventy-eight, eighty, and ninety.

2. Write in words: 0, 30, 22, 84, 60, and 98.

3. How many cents are there in 3 dimes?

4. I am thinking of two numbers whose sum is 17. One of the numbers is 9. What is the other number?

5. I am thinking of two numbers whose difference is 17. One of the numbers is 19. What is the other number?

Copy the following and add:

6.	7.	8.	9.	10.	11.
15	25	45	26	56	43
6	14	14	32	32	34

Copy the following and subtract:

12.	13.	14.	15.	16.	17.
59	68	57	78	59	67
20	32	27	70	39	15

Copy the following and add:

18.	19.	20.	21.	22.	23.
3	6	4	2	5	8
4	7	0	3	1	2
9	8	7	7	9	3

24. Draw 14 short lines on paper and find, by counting, how many lines there are in $\frac{1}{2}$ of 14 lines.

25. How many eggs are there in $2\frac{1}{4}$ doz. eggs?

26. How many pints are there in $1\frac{1}{2}$ qt.? in $2\frac{1}{2}$ qt.?

The pupil cannot safely progress farther unless he can answer questions like those given above. Such pages should be reviewed frequently.

IX. LITTLE EXAMINATIONS

I.	1. $3 + 9$.	5. $\frac{1}{2}$ of 8.	9. 2 pt. = (?) qt.
	2. $17 - 8$.	6. $\frac{1}{4}$ of 12.	10. 1 yd. = (?) ft.
	3. $22 + 6$.	7. $\frac{1}{4}$ of 8¢.	11. $1\frac{1}{2}$ doz. = (?).
	4. $45 - 30$.	8. $\frac{1}{2}$ of 6¢.	12. $12 + 23$.
II.	1. $5 + 8$.	5. $\frac{1}{2}$ of 8 ft.	9. 4 pt. = (?) qt.
	2. $14 - 6$.	6. $\frac{1}{4}$ of 8 ft.	10. 1 ft. = (?) in.
	3. $42 + 10$.	7. $\frac{1}{4}$ of 12 in.	11. $2\frac{1}{2}$ doz. = (?).
	4. $62 - 31$.	8. $\frac{1}{2}$ of 12 in.	12. $23 + 45$.
III.	1. $37 + 12$.	5. $\frac{1}{2}$ of 10¢.	9. 1 pt. = (?) qt.
	2. $14 - 7$.	6. $\frac{1}{4}$ of 8 in.	10. 2 yd. = (?) ft.
	3. $52 + 13$.	7. $\frac{1}{4}$ of 12 lb.	11. $1\frac{1}{4}$ doz. = (?).
	4. $74 - 21$.	8. $\frac{1}{4}$ of 12 qt.	12. $51 + 41$.
IV.	1. $54 + 25$.	5. $\frac{1}{2}$ of 10.	9. 6 pt. = (?) qt.
	2. $13 - 5$.	6. $\frac{1}{2}$ of \$10.	10. 2 ft. = (?) in.
	3. $38 + 20$.	7. $\frac{1}{4}$ of 12¢.	11. $2\frac{1}{4}$ doz. = (?).
	4. $66 - 22$.	8. $\frac{1}{4}$ of \$12.	12. $31 + 22$.
V.	1. $72 + 17$.	5. $\frac{1}{2}$ of 20.	9. 2 qt. = (?) pt.
	2. $13 - 6$.	6. $\frac{1}{2}$ of 14.	10. 6 ft. = (?) yd.
	3. $73 + 14$.	7. $\frac{1}{2}$ of 12 lb.	11. $\frac{3}{4}$ doz. = (?).
	4. $79 - 32$.	8. $\frac{1}{4}$ of 16.	12. $33 + 40$.

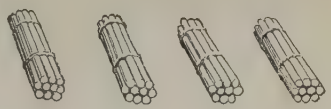
These Little Examinations at the close of each chapter furnish excellent review drill work. The time should be recorded for each, and the pupils should endeavor to improve their records. This work may also be used for review in the first part of the next chapter.

CHAPTER II

I. NUMBERS TO 1000

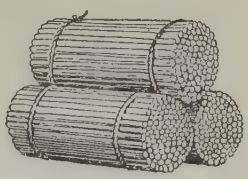
TENS AND HUNDREDS

1. Here are 4 bundles of splints, 10 in a bundle. How many splints are there? Write the number on the blackboard.

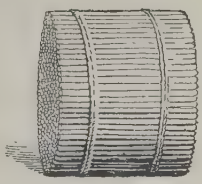


2. If there are 5 such bundles of splints, how many splints are there in all? Write the number on the blackboard.

3. Here are 3 bundles of splints, 100 in a bundle. How many splints are there? Write the number on the blackboard. If there were 400 more, how many splints would there be? Write the number on the blackboard.



4. Here is a larger bundle of splints, containing as many splints as there are in 10 bundles of 100 each. How many hundred splints are there in this bundle?



5. How many 10's are there in 100? How many 100's are there in ten 100's, or 1000? What is the name for ten 10's? What is the name for ten 100's?

READING AND WRITING NUMBERS

Numbers 1 to 5, oral

1. How many splints are there in this picture?

300 + 40 + 2

2. Read these numbers:

332	472	100	101	203	110	909
352	492	200	202	230	121	990
372	412	900	404	705	111	999

3. Open this book at page 126; at page 101.

4. The numbers below 10 are called *units*, or *ones*. We write the units in the right-hand place. In the number 26 there are 2 tens and 6 units. Where do we write the tens? In 326 where do we write the hundreds?

5. Name the figure in units' place in 475; the figure in tens' place; the figure in hundreds' place.

Write in figures:

6. Six hundred sixty-six.
7. Three hundred forty-one.
8. Five hundred sixty-nine.
9. Four hundred nine.
10. Seven hundred three.
11. Eight hundred eight.

Write in words:

12. 175. 13. 483. 14. 700. 15. 896. 16. 980.

READING AND WRITING NUMBERS

Numbers 1 to 4, oral

Read these numbers:

1.	308	218	237	247	296	408	345
2.	448	479	498	478	630	824	446
3.	596	582	607	927	636	888	989

4. What is the units' figure in 750? the tens' figure? the hundreds' figure?

Write in figures:

5. One hundred two.
6. Two hundred four.
7. Three hundred nine.
8. Four hundred three.
9. Six hundred seven.
10. One hundred sixteen.
11. One hundred sixty.
12. Four hundred ninety.
13. Six hundred forty.
14. Eight hundred eighteen.

Write in words:

15. 328.	17. 834.	19. 978.	21. 842.	23. 508.
16. 808.	18. 608.	20. 800.	22. 630.	24. 1000.

Write in figures:

25. Sixty-three.
26. Thirty-two.
27. Fifty-eight.
28. Ninety-eight.
29. Four hundred.
30. Nine hundred.
31. Six hundred seventy-eight.
32. Eight hundred eighty-two.
33. Four hundred ninety-one.
34. Two hundred seventy-eight.
35. Three hundred sixty-two.
36. Nine hundred twenty-one.

Roman Numerals. The figures often seen on clocks are called *Roman numerals*, and are as follows:

I	II	III	IV (or IIII)	V	VI	VII	VIII	IX	X	XI	XII
1	2	3	4	5	6	7	8	9	10	11	12

Time. Read and learn:

60 minutes = 1 hour
24 hours = 1 day

We write min. for minute or minutes, hr. for hour or hours, da. for day or days, A.M. for forenoon, and P.M. for afternoon. We write 15 minutes after 2 in any of these four ways: 2 15, 2:15, 2.15, or 2 hr. 15 min.

READING CLOCK NUMBERS

1. Read the figures on the face of this clock.
2. Which hand tells the hours? Which tells the minutes?
3. How long does it take the hour hand to pass from I to II? How long does it take the minute hand to pass from I to II?
4. How long does it take the hour hand to pass around from XII to XII again? How long does it take the minute hand?

5. What time is it by the clock in the picture? What time is it by the school clock?
6. How many minutes in an hour? in $\frac{1}{2}$ hour?

II. ADDITION

Adding Numbers. 1. Suppose that Jane goes to the store and buys some fruit for 46¢ and some eggs for 37¢. How much money must she pay?

We see that 7 units and 6 units are 13 units, and we write the 3 in units' column and add the 1 to the tens.

Then $1 + 3 + 4 = 8$, and we write the 8 in tens' column.

Addends	46
	37
Sum	83

The sum is 83, and so Jane must pay 83¢ in all.

2. Suppose that Jack has 24 marbles in one bag, 38 marbles in another bag, and 16 marbles in his pocket. How many marbles has he in all?

We see that the sum of the units is $6 + 8 + 4$, or 18, and we write the 8 in units' column and add the 1 to the tens.

Then $1 + 1 + 3 + 2 = 7$, and we write the 7 in tens' column.

The sum is 78, and so Jack has 78 marbles.

24
38
16
78

The terms "addend" and "sum" should be explained orally. Formal definitions of such terms are not desirable.

The teacher should add the units and tens separately on the blackboard, so as to show the reasonableness of the above process, but it is not necessary or even desirable that the pupil should explain the process himself. Mechanical efficiency, the formation of the habit of adding rapidly and accurately, is the important thing at this time. Modern education, being chiefly concerned with efficiency, pays little attention to formal memorized statements.

46
37
13 = sum of units
7 = sum of tens
83 = sum of numbers

PROBLEMS ABOUT THE CLASS

1. If there are 14 boys and 13 girls in our class, how many pupils are there in all?

2. In one class there are 18 boys and 22 girls. How many pupils in all are there? Find, by counting, how many more girls there are than boys.

3. In one class there are 25 boys and 27 girls. How many pupils are there in the class?

4. The schoolroom is 36 ft. long and 24 ft. wide. Find the sum of the length and width.

5. Each desk is 22 in. long and 14 in. wide. How many inches all round the top of a desk?

6. Write a problem about the class, as in Ex. 3, and solve it.

DRILL WORK

See how long it takes to copy and add:

1. 20 36	11. 24 36	21. 36 36	31. 48 23	41. 55 35	51. 55 25
2. 32 38	12. 44 47	22. 65 18	32. 35 45	42. 45 17	52. 47 17
3. 22 48	13. 47 26	23. 39 29	33. 46 36	43. 29 16	53. 33 58
4. 25 35	14. 56 39	24. 66 24	34. 37 17	44. 33 18	54. 66 19
5. 38 26	15. 73 19	25. 45 15	35. 26 39	45. 78 16	55. 35 28
6. 49 27	16. 52 29	26. 25 39	36. 34 46	46. 37 27	56. 49 16
7. 36 28	17. 38 43	27. 67 23	37. 58 25	47. 27 46	57. 58 18
8. 29 47	18. 36 18	28. 36 37	38. 72 19	48. 44 37	58. 25 38
9. 21 19	19. 43 49	29. 47 38	39. 19 39	49. 49 29	59. 47 36
10. 21 28 24	20. 21 32 29	30. 32 49 30	40. 13 38 34	50. 16 48 27	60. 14 27 35

Adding Three-Figure Numbers. We often have to add numbers of three figures.

Fred worked on Saturday for Mr. Sinclair, the grocer. Mr. Sinclair told Fred to look over two boxes of apples and throw away the bad ones. Fred found 156 good apples in one box and 117 in the other box. How many good apples did he find in all?

$$\begin{array}{r} 156 \\ 117 \\ \hline 273 \end{array}$$

We see that we must add 156 and 117.

7 units + 6 units = 13 units = 1 ten + 3 units. We write the 3 in units' column and add the 1 to the tens.

1 ten + 1 ten + 5 tens = 7 tens. We write the 7 in tens' column.

1 hundred + 1 hundred = 2 hundreds. We write the 2 in hundreds' column.

The sum is 273, and so Fred found 273 good apples.

USES OF ADDITION

1. There are 152 oranges in one box and 108 in another box. How many oranges are there in both boxes?

2. There are 138 boys and 143 girls in a school. How many pupils are there in the school?

3. John tied 426 ft. of string and 146 ft. of string together to make a kite string. How long was it then?

Add the following, and check the work:

4.	5.	6.	7.	8.	9.
378	448	526	428	406	$428
206	329	247	333	306	325

Addition Continued. Mr. Sinclair told Fred to count the oranges which were left after the day's sale. There were 172 oranges in one box and 156 in another box. How many oranges were left in the two boxes?

172
156
328

We see that we must add 172 and 156.

6 units + 2 units = 8 units. We write the 8 in units' column.

5 tens + 7 tens = 12 tens = 1 hundred + 2 tens. We write the 2 in tens' column and add the 1 to the hundreds.

1 hundred + 1 hundred + 1 hundred = 3 hundreds. We write the 3 in hundreds' column.

The sum is 328, and so there are 328 oranges left.

The teacher will observe that on page 54 the sum of the units was more than ten, while on this page the sum of the tens is more than 10 (tens). On page 56 the general case is considered.

USES OF ADDITION

1. There are 240 sheep in one pasture and 178 sheep in another pasture. How many sheep are there in all?

2. It is 146 miles from here to the place where Frank lives, and 163 miles farther to the place where Will lives. How far is it from here to the place where Will lives?

Add the following, and check the work:

3.	**4.**	**5.**	**6.**	**7.**	**8.**
364	475	286	292	480	$275
242	352	360	374	370	360

Addition Continued. Mr. Jones has a corner lot. He is building a picket fence on the sides facing the two streets. He needs 196 pickets on one side and 188 on the other side. How many pickets does he need in all?

We see that we must add 196 and 188.

8 units + 6 units = 14 units = 1 ten + 4 units. We write the 4 in units' column and add the 1 to the tens.

196
188
384

1 ten + 8 tens + 9 tens = 18 tens = 1 hundred + 8 tens. We write the 8 in tens' column and add the 1 to the hundreds.

1 hundred + 1 hundred + 1 hundred = 3 hundreds. We write the 3 in hundreds' column.

The sum is 384, and so Mr. Jones needs 384 pickets.

ADDING NUMBERS

1. If Mr. Jones needs 246 pickets for a fence on one side of his lot and 278 pickets for a fence on another side, how many pickets does he need for both sides?

Add the following, and check the work:

2.	**3.**	**4.**	**5.**	**6.**	**7.**
389	456	648	382	455	338
368	285	268	99	276	473

8.	**9.**	**10.**	**11.**	**12.**	**13.**
100	201	310	142	224	278
225	388	228	386	474	306
295	322	293	285	199	48

III. SUBTRACTION

Subtraction. If there are 47 pupils in one room and 28 in another, how many more pupils are there in the first room than in the second?

Minuend	47
Subtrahend	28
Difference	19

We subtract as here shown.

We cannot take 8 units from 7 units, so we take 1 ten of the 4 tens, making 10 units, and put it with the 7 units, making 17 units.

Then 17 units − 8 units = 9 units.

Then 2 tens from the 3 tens remaining leaves 1 ten.

The difference is 1 ten and 9 units, or 19.

Show that we check the work by adding the difference to the subtrahend, the sum being the minuend.

The terms "minuend," "subtrahend," and "difference" (or "remainder") should be explained orally. They are of little value except in explaining the check on subtraction. For suggestions as to the treatment of subtraction the teacher should consult page 248.

USES OF SUBTRACTION

1. Robert has 19 marbles and Will has 31. How many more marbles has Will than Robert?

2. A schoolroom is 36 ft. long and 28 ft. wide. It is how much longer than wide?

3. In playing a game Rachel's score was 32 and Ruth's was 24. Find the difference in their scores.

4. A girl has a piece of cloth 42 in. long. She cuts off 1 yd. for a doll's dress. How much has she left?

SUBTRACTING NUMBERS

Subtract, and check the work:

1. 63	6. 61	11. 75	16. 82	21. 85	26. 90
29	42	38	54	38	46
2. 84	7. 86	12. 74	17. 82	22. 92	27. 90
66	58	28	43	44	37
3. 84	8. 83	13. 93	18. 73	23. 66	28. 63
56	48	39	45	39	39
4. 76	9. 86	14. 84	19. 77	24. 85	29. 90
48	49	26	38	58	47
5. 60	10. 70	15. 80	20. 41	25. 52	30. 81
18	27	36	18	24	18

31. There are 62 children at a picnic in the park. If 34 of them are boys and the rest are girls, how many girls are there?

32. There are 32 pupils in our room. If 16 are boys and the rest are girls, how many girls are there?

33. A ball costs 50¢, and I have only 36¢. How much more must I have in order to buy the ball?

34. There are 32 children in one class and 26 in another. How many more are there in one class than in the other?

35. A man has 75 hens and sells 58 of them. How many hens has he left?

Subtracting Three-Figure Numbers. If there are 701 children in one city school and 240 in another, how many more are there in one school than in the other?

$$\begin{array}{r} 701 \\ 240 \\ \hline 461 \end{array}$$

We see that we must subtract 240 from 701.

We write the numbers as here shown.

We see that $1 - 0 = 1$, and we write the 1 in units' column.

We cannot take 4 tens from 0 tens, so we take 1 hundred of the 7 hundreds, making 100, or 10 tens.

Then 10 tens $-$ 4 tens $=$ 6 tens, and we write the 6 in tens' column.

The 7 hundreds is now 6 hundreds, because we took 1 hundred away.

Then 6 hundreds $-$ 2 hundreds $=$ 4 hundreds, and we write the 4 in hundreds' column.

The difference is 461, and so there are 461 more children in one school than in the other.

We check the work by adding 240 to 461.

DRILL WORK

Subtract, and check the work:

1. 732	4. 743	7. 754	10. 765	13. 708
250	270	290	283	296
2. 583	5. 842	8. 927	11. 916	14. 823
291	391	645	424	460
3. 839	6. 819	9. 829	12. 935	15. 708
567	577	577	442	523

Further Work in Subtraction. If there are 731 pupils in one city school and 246 in another, how many more are there in the first school than in the second?

We see that we must subtract 246 from 731.

To subtract 246 from 731 we write the numbers as here shown.

$$\begin{array}{r} 731 \\ 246 \\ \hline 485 \end{array}$$

We cannot take 6 from 1, so we take 1 ten of the 3 tens and put it with the 1, making 11.

Then $11 - 6 = 5$, and we write the 5 in units' column.

The 3 tens are now 2 tens, because we took 1 ten away. We cannot take 4 tens from 2 tens, so we take 1 hundred of the 7 hundreds and put it with the 2 tens, making 120, or 12 tens.

Then 12 tens $-$ 4 tens $=$ 8 tens, and we write the 8 in tens' column.

Then 6 hundreds $-$ 2 hundreds $=$ 4 hundreds, and we write the 4 in hundreds' column.

The difference is 485, and so there are 485 more pupils in the first school than in the second.

Another Example. If there are 700 pupils in one school and 246 in another, how many more are there in the first school than in the second?

We see that we must subtract 246 from 700.

We cannot take 6 from 0, or 4 from 0, so we think of 700 as $600 + 90 + 10$.

$$\begin{array}{r} 700 \\ 246 \\ \hline 454 \end{array}$$

Then $10 - 6 = 4$, 9 tens $-$ 4 tens $=$ 5 tens, and 6 hundreds $-$ 2 hundreds $=$ 4 hundreds.

The difference is 454, and so there are 454 more pupils in the first school than in the second.

DRILL WORK

Subtract, and check the work:

1. 813 285	8. 825 350	15. 934 686	22. 800 288	29. 635 539
2. 614 296	9. 752 392	16. 832 498	23. 824 356	30. 900 206
3. 615 396	10. 716 689	17. 726 238	24. 822 487	31. 720 543
4. 832 266	11. 934 496	18. 941 456	25. 500 204	32. 834 426
5. 812 338	12. 714 327	19. 603 94	26. 803 286	33. 800 268
6. 618 329	13. 623 398	20. 712 338	27. 938 579	34. 845 298
7. 920 284	14. 832 466	21. 820 485	28. 623 435	35. 800 318

36. If John picks 424 apples and James picks 288, how many more apples does John pick than James?

37. In a city school of 923 pupils 468 are girls and the rest are boys. How many boys are there?

38. It is 660 ft. round a running track. After a boy has run 525 ft. of this distance, how much farther must he run to go all the way round?

ORAL REVIEW TEST

Subtract each of the numbers 2, 3, 4, 5, 6, 7, 8, and 9, in turn, from each of the following numbers:

1. 20	22	30	42	53	64	73	88	92
2. 44	52	61	10	97	72	71	40	80
3. 51	81	95	31	85	60	43	63	62
4. 96	32	74	84	55	95	76	54	86
5. 65	93	91	82	83	11	50	70	75

WRITTEN REVIEW TEST

Subtract 395 from each of these numbers:

1. 612. **2.** 601. **3.** 625. **4.** 736. **5.** 857.

Subtract 279 from each of these numbers:

6. 525. **7.** 736. **8.** 848. **9.** 712. **10.** 900.

Subtract 268 from each of these numbers:

11. 606. **12.** 721. **13.** 632. **14.** 703. **15.** 912.

Subtract 237 from each of these numbers:

16. 525. **17.** 402. **18.** 316. **19.** 923. **20.** 800.

Subtract 476 from each of these numbers:

21. 941. **22.** 623. **23.** 800. **24.** 912. **25.** 713.

Subtract 524 from each of these numbers:

26. 821. **27.** 912. **28.** 901. **29.** 815. **30.** 800.

If the check is insisted upon, it will also give a review of addition.

IV. MULTIPLICATION AND DIVISION TABLES

NEED FOR MULTIPLICATION

1. Edward's father has sent him to buy 3 two-cent postage stamps for local letters. How much must he pay for the 3 stamps?

2. How much is $2+2$? How much is $2+2+2$? How much is $2+2+2+2$?

3. If Edward's father buys 4 two-cent postage stamps, how much money must he pay?

4. If Edward's father has 5 local letters to mail, how much do the stamps cost for all of these letters? Which is better, to add $2+2+2+2+2$, or to know without adding how many five 2's are?

5. Edward did not know how many six 2's are, and his father told him to count by 2's like this: 2, 4, 6, and so on. Then Edward found how many six 2's are. How many are they?

6. How many shoes are 6 pairs of shoes? 7 pairs?

7. Count by 2's from 2 to 20. How many 2's make 12? How many 2's make 18?

8. How much is twice $2¢$? three times $2¢$?

When a new subject is begun, it is advisable to introduce real, concrete problems relating to the interests of the pupils, so as to show the purpose of the work. The above work should be treated orally.

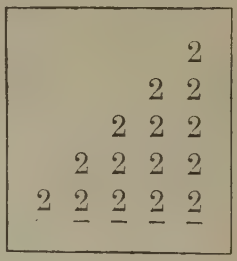
The teacher should explain the meaning of "twice" and "three times" in Ex. 8 and should also explain orally the meaning of the terms "multiplicand," "multiplier," and "product."

LEARNING ABOUT TWO

All work oral

1. Add the columns of 2's, from one 2 to five 2's.

2. On the blackboard and on paper build more columns of 2's, until you have twelve 2's in the last column. How many columns of 2's are there?



3. Read the columns, thus: "One 2 is 2, two 2's are 4, three 2's are 6," and so on to "twelve 2's are 24."

4. How many are five 2's? six 2's? seven 2's? eight 2's? twelve 2's?

5. Read and learn the table of 2's, thus: "Two 2's are 4" (or else "two times 2 are 4"), and so on:

$1 \times 2 = 2$	$5 \times 2 = 10$	$9 \times 2 = 18$
$2 \times 2 = 4$	$6 \times 2 = 12$	$10 \times 2 = 20$
$3 \times 2 = 6$	$7 \times 2 = 14$	$11 \times 2 = 22$
$4 \times 2 = 8$	$8 \times 2 = 16$	$12 \times 2 = 24$

6. How much is 2×0? 0×2? 1×0? 0×1?

7. How much is $2 + 2 + 2 + 2$? 4×2?

8. State the value of each of the following:

2×3	2×7	2×8	2×5
2×6	2×4	2×9	2×10

By being shown that 6×2 dots $= 2 \times 6$ dots, the pupils should be led to see that if they know 6×2, they also know 2×6; therefore these inverse drills should be carried right along with the tables.

MULTIPLYING BY TWO

Numbers 1 to 20, oral

1. At 2¢ each, how much will 3 apples cost?
2. At 2¢ each, how much will 5 apples cost?
3. At 2¢ each, how much will 6 newspapers cost?

At 2¢ each, find the cost of each of the following:

4. 4 apples.
5. 2 papers.
6. 3 pears.
7. 5 stamps.
8. 7 pens.
9. 8 post cards.
10. 9 cookies.
11. 6 plums.

If $5 \times 2 + 1$ is equal to 11, state the value of:

12. $5 \times 2 + 3$.
13. $4 \times 2 + 1$.
14. $3 \times 2 + 1$.
15. $8 \times 2 + 5$.
16. $9 \times 2 + 4$.
17. $7 \times 2 + 3$.
18. $6 \times 2 + 1$.
19. $8 \times 2 + 3$.
20. $5 \times 2 + 4$.

This carrying drill is of great importance in the multiplication of numbers of two or more figures, and should be thoroughly understood.

Multiply the following:

21.	2	2	4	2	2	2	1	9	0	12
	2	4	2	6	8	9	3	2	2	0
22.	2	3	2	5	2	6	1	2	7	12
	3	2	5	2	7	2	2	1	2	2
23.	1	0	5	1	0	9	1	0	8	11
	1	3	0	7	0	1	9	8	0	2

DIVIDING BY TWO

All work oral

1. How many 2's do you see in 4?
2. How many 2's do you see in 6?
3. How many 2's do you see in 8?
4. 8 contains 2 how many times?
5. Instead of saying that 10 contains 2 five times, we may say that 10 divided by 2 is 5, and we may write this $10 \div 2 = 5$, $\frac{1}{2}$ of $10 = 5$, or as in the first of the following:

				2
			2	2
		2	2	2
	2	2	2	2
2	2	2	2	2
2	4	6	8	10

$2\overline{)10}$ $\quad$ Divisor = $2\overline{)10}$ = Dividend

$\underline{5}$ $\quad$ $\underline{5}$ = Quotient

What does $8 \div 2$ equal? What does $6 \div 2$ equal?

6. State the value of each of the following:

4×2 $\quad$ 2×4 $\quad$ $8 \div 2$ $\quad$ $\frac{1}{2}$ of 8 $\quad$ $8 \div 4$

7. Read and learn this table:

$2 \div 2 = 1$	$10 \div 2 = 5$	$18 \div 2 = 9$
$4 \div 2 = 2$	$12 \div 2 = 6$	$20 \div 2 = 10$
$6 \div 2 = 3$	$14 \div 2 = 7$	$22 \div 2 = 11$
$8 \div 2 = 4$	$16 \div 2 = 8$	$24 \div 2 = 12$

The quotient is sometimes placed above the dividend, as in long division, and any school may require this arrangement. It is not the business custom, however, and it is inconvenient in some advanced work.

The teacher should explain orally the terms "dividend," "divisor," and "quotient," and show that we may check division by finding if the product of the quotient and the divisor is equal to the dividend.

LEARNING ABOUT THREE

Numbers 1 to 7, oral

1. Add the columns of 3's, from one 3 to five 3's.

2. On the blackboard and on paper build more columns of 3's, until you have twelve 3's in the last column. How many columns of 3's are there?

3. Read the columns, thus: "One 3 is 3, two 3's are 6, three 3's are 9," and so on to "twelve 3's are 36."

4. How many are five 3's? six 3's? seven 3's? eight 3's? nine 3's? ten 3's?

5. Read and learn the table of 3's, thus: "Two 3's are 6" (or else "two times 3 are 6"), and so on:

$1 \times 3 = 3$	$5 \times 3 = 15$	$9 \times 3 = 27$
$2 \times 3 = 6$	$6 \times 3 = 18$	$10 \times 3 = 30$
$3 \times 3 = 9$	$7 \times 3 = 21$	$11 \times 3 = 33$
$4 \times 3 = 12$	$8 \times 3 = 24$	$12 \times 3 = 36$

6. How many are 3×0? 0×3?

7. State the value of each of the following:

3×2	3×7	3×9	3×4
3×3	3×5	3×6	3×8

Copy and complete the following:

8. $2 \times (\quad) = 6$. **10.** $(\quad) \times 3 = 12$. **12.** $2 \times 3 = (\quad)$.

9. $3 \times (\quad) = 9$. **11.** $(\quad) \times 3 = 15$. **13.** $7 \times 3 = (\quad)$.

Frequently review and apply all preceding tables.

MULTIPLYING BY THREE

Numbers 1 to 12, oral

1. Count by 3's from 3 to 36.

2. Repeat the multiplication table of 3's to 12×3.

State the value of each of the following:

3. $4 \times 3 + 1$.
4. $7 \times 3 + 5$.
5. $5 \times 3 + 2$.
6. $8 \times 3 + 1$.
7. $6 \times 3 + 2$.
8. $9 \times 3 + 3$.

9. How many are 3×0? 0×3? 2×0? 0×2?

10. If 1 apple costs 3¢, how much will 6 apples cost? How much will 9 apples cost?

11. If 1 pear costs 3¢, how much will 7 pears cost? How much will 8 pears cost?

12. If 1 piece of burlap used in making a carpet for a doll's house costs 3¢, how much will 8 pieces cost?

Copy and complete the following:

13. $4 \times (\quad) = 12$.
14. $6 \times (\quad) = 18$.
15. $9 \times (\quad) = 27$.
16. $8 \times (\quad) = 24$.
17. $2 \times (\quad) = 6$.
18. $5 \times (\quad) = 15$.
19. $7 \times (\quad) = 21$.
20. $3 \times (\quad) = 33$.
21. $(\quad) \times 3 = 0$.
22. $(\quad) \times 3 = 24$.
23. $(\quad) \times 3 = 18$.
24. $(\quad) \times 3 = 36$.

25. If 1 chair costs \$3, how much will 7 chairs cost?

The pupil should write: $7 \times \$3 = \$21$.

26. If 1 school desk costs \$3, how much will 12 school desks cost? How much will 11 school desks cost?

27. If 1 pair of shoes costs \$3, how much would you have to pay for 9 pairs? for 11 pairs? for 8 pairs? for 7 pairs?

DIVIDING BY THREE

Numbers 1 to 7, oral

				3
			3	3
		3	3	3
	3	3	3	3
3	3	3	3	3
3	6	9	12	15

1. How many 3's do you see in 6? How many 3's do you see in 9?

2. How many 3's are there in 12? How many 3's are there in 15?

3. How many more 3's are there in 15 than there are in 12?

4. How many are 8×3? $24 \div 3$?

5. How many are 6×3? $18 \div 6$?

6. State the value of each of the following:

4×3 $\quad$ 3×4 $\quad$ $12 \div 3$ $\quad$ $12 \div 4$

7. If $\frac{1}{3}$ of 27 means $27 \div 3$, $\frac{1}{3}$ of 27 are how many?

The teacher should explain that $\frac{1}{3}$ is read "one third," and that $\frac{1}{3}$ of 27 is only another way of saying "27 divided by 3." The concrete fraction work with thirds, fourths, and so on is taken up later.

8. At 3¢ each, how many apples can you buy for 24¢?

The pupil should write: $24¢ \div 3¢ = 8$.

9. At 3¢ each, how many pencils can you buy for 12¢? for 18¢? for 21¢? for 27¢? for 36¢?

10. At 3¢ each, how many apples can you buy for 9¢ and 12¢ together? for 8¢ and 13¢ together?

11. How many threes in a dozen? in a half dozen?

Copy and complete the following:

12. $(\quad) \div 3 = 9$. **14.** $(\quad) \div 3 = 6$. **16.** $(\quad) \div 3 = 8$.

13. $(\quad) \div 3 = 7$. **15.** $(\quad) \div 3 = 5$. **17.** $(\quad) \div 3 = 4$.

DIVIDING BY THREE

Numbers 1 to 8, oral

1. At 3¢ each, how many cakes can you buy for 12¢? for 18¢? for 6¢? for 9¢? for 15¢?

2. If 3 coats cost $24, how much does each coat cost?

3. If a freight train goes a mile in 3 minutes, how many miles will it go in 30 minutes?

4. How many yards are there in 30 ft.? in 27 ft.?

5. At 3¢ a yard, how many yards of braid can you buy for 18¢? for 21¢? for 27¢? for 15¢? for 30¢?

6. If you need 27 sheets of paper to make 3 notebooks, how many sheets do you need for 1 notebook?

7. At 3¢ each, how many apples can you buy for 30¢? for 21¢? for 12¢? for 18¢?

8. If you need 3 yd. of cloth for each skirt, how many skirts of this kind can you make from 27 yd.?

9. Copy this table and learn it:

$3 \div 3 = 1$	$15 \div 3 = 5$	$27 \div 3 = 9$
$6 \div 3 = 2$	$18 \div 3 = 6$	$30 \div 3 = 10$
$9 \div 3 = 3$	$21 \div 3 = 7$	$33 \div 3 = 11$
$12 \div 3 = 4$	$24 \div 3 = 8$	$36 \div 3 = 12$

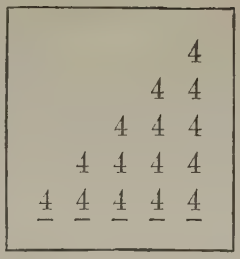
Copy and complete the following:

10. $9 \div (\ ) = 3$.	13. $6 \div (\ ) = 3$.	16. $\frac{1}{3}$ of $36 = (\ )$.
11. $12 \div (\ ) = 6$.	14. $6 \div (\ ) = 2$.	17. $\frac{1}{3}$ of $(\ ) = 8$.
12. $12 \div (\ ) = 4$.	15. $8 \div (\ ) = 4$.	18. $(\ )$ of $15 = 5$.

Frequently review and apply all preceding tables.

LEARNING ABOUT FOUR

All work oral



1. Add the columns of 4's, from one 4 to five 4's.

2. On the blackboard and on paper build more columns of 4's, until you have twelve 4's in the last column. Then read the columns, thus: "One 4 is 4, two 4's are 8," and so on.

3. How many are 4×0? 0×4?

4. Read and learn the table of 4's:

$1 \times 4 = 4$	$5 \times 4 = 20$	$9 \times 4 = 36$
$2 \times 4 = 8$	$6 \times 4 = 24$	$10 \times 4 = 40$
$3 \times 4 = 12$	$7 \times 4 = 28$	$11 \times 4 = 44$
$4 \times 4 = 16$	$8 \times 4 = 32$	$12 \times 4 = 48$

5. State the value of each of the following:

4×3	4×8	4×9	4×7
4×5	4×6	4×2	4×10

6. There are 4 qt. in 1 gallon. How many quarts are there in 5 gallons? in 7 gallons? in 9 gallons?

7. A cat has 4 feet. How many feet have 8 cats?

8. A cow has 4 feet. How many feet have 2 cows? 7 cows? 6 cows? 5 cows? 10 cows?

9. If a man can earn $4 a day, how many dollars can he earn in 9 da.? in 7 da.? in 8 da.?

10. How many sides do 6 rectangles have?

MULTIPLYING BY FOUR

Numbers 1 to 12, oral

1. How many dots are there in each of these squares? How many squares are there in the upper row? How many dots are there in the squares of the upper row?

2. How many dots are there in the squares of the lower row? How can you find this without adding all the dots in the squares of this row?

3. How many squares are there in all? How can you find the number of dots without adding? How many dots are there in all?

State the value of each of the following:

4. $5 \times 4 + 1$.
5. $7 \times 4 + 3$.
6. $6 \times 4 + 2$.
7. $8 \times 4 + 3$.
8. $9 \times 4 + 2$.
9. $4 \times 4 + 3$.
10. $3 \times 4 + 2$.
11. $2 \times 4 + 1$.
12. $8 \times 4 + 2$.

13. There are 4 stalks of corn in a hill. How many stalks are there in 9 such hills? in 11 such hills?

14. If there are 4 apples in each of 12 piles, how many apples are there in all the piles?

15. How many shoes does it take to shoe 6 horses? to shoe 5 horses? to shoe both 6 horses and 5 horses?

16. One man has 3 horses to be shod and another man has 9 horses to be shod. How many shoes are needed for all the horses?

DIVIDING BY FOUR

Numbers 1 to 9, oral

1. How many times does 8 contain 4?

2. How many 4's do you see in 12? in 20? in 16?

3. How many times does 16¢ contain 4¢? 20¢ contain 4¢?

4. State the value of:

2×4 4×2 $8 \div 4$ $8 \div 2$

5. Find $\frac{1}{3}$ of 12; $\frac{1}{4}$ of 16.

Explain, if necessary, that $\frac{1}{4}$ is read "one fourth," and that $\frac{1}{4}$ of 16 means $16 \div 4$.

				4
			4	4
		4	4	4
	4	4	4	4
4	4	4	4	4
4	8	12	16	20

6. If four boys have equal scores in a game and the total score is 20, what is each score?

7. Read and learn this table:

$4 \div 4 = 1$	$20 \div 4 = 5$	$36 \div 4 = 9$
$8 \div 4 = 2$	$24 \div 4 = 6$	$40 \div 4 = 10$
$12 \div 4 = 3$	$28 \div 4 = 7$	$44 \div 4 = 11$
$16 \div 4 = 4$	$32 \div 4 = 8$	$48 \div 4 = 12$

8. In 1 gallon there are 4 qt. How many gallons are there in 32 qt.? in 44 qt.? in 28 qt.? in 36 qt.?

9. If 48 boys are marching, 4 in a line, how many lines of boys are there?

Copy and complete the following:

10. $24 \div 4 = (\ )$. **12.** $16 \div (\ ) = 4$. **14.** $\frac{1}{4}$ of $40 = (\ )$.

11. $32 \div 4 = (\ )$. **13.** $28 \div (\ ) = 7$. **15.** $\frac{1}{4}$ of $(\ ) = 12$.

LEARNING ABOUT FIVE

Numbers 1 to 8, oral

1. Add the columns of 5's, from one 5 to five 5's.

2. On the blackboard and on paper build more columns of 5's, until you have twelve 5's in the last column. Then read the columns, thus: "One 5 is 5, two 5's are 10," and so on.

				5
			5	5
		5	5	5
	5	5	5	5
5	5	5	5	5

3. Read and learn the table of 5's:

$1 \times 5 = 5$	$5 \times 5 = 25$	$9 \times 5 = 45$
$2 \times 5 = 10$	$6 \times 5 = 30$	$10 \times 5 = 50$
$3 \times 5 = 15$	$7 \times 5 = 35$	$11 \times 5 = 55$
$4 \times 5 = 20$	$8 \times 5 = 40$	$12 \times 5 = 60$

4. How many are 5×0? 0×5? 5×11? 5×12?

5. State the value of each of the following:

5×3	5×9	5×6	5×4
5×7	5×2	5×8	5×10

6. If we go to school 5 days a week for 12 weeks, how many days are we in school?

7. If it costs 5¢ to telephone and a man telephones 9 times, how much does it cost him?

8. If a class marches in rows of 5 and there are 11 rows, how many pupils are there in the class?

Copy and complete the following:

9. $4 \times 5 + 2 = (\ )$.

10. $9 \times 5 + 7 = (\ )$.

11. $6 \times 5 + 3 = (\ )$.

12. $5 \times 5 + 4 = (\ )$.

DIVIDING BY FIVE

Numbers 1 to 5, oral

1. How many 5's are there in 5? in 10? in 20? in 15? in 30? in 45? in 35? in 50? in 55? in 60?

2. State rapidly the value of each of the following:

$40 \div 5$ $\quad \frac{1}{5}$ of 30 $\quad 15 \div 5$ $\quad \frac{1}{5}$ of 35

3. Read and learn this table:

$5 \div 5 = 1$	$25 \div 5 = 5$	$45 \div 5 = 9$
$10 \div 5 = 2$	$30 \div 5 = 6$	$50 \div 5 = 10$
$15 \div 5 = 3$	$35 \div 5 = 7$	$55 \div 5 = 11$
$20 \div 5 = 4$	$40 \div 5 = 8$	$60 \div 5 = 12$

4. At 5¢ each, how many oranges can you buy for 20¢? for 40¢? for 25¢? for 50¢? for 45¢? for 60¢?

5. At \$5 a day, how many days must a man work in order to earn \$30? to earn \$45? to earn \$60?

Copy and complete the following:

6. $35 \div (\ ) = 7$.
7. $45 \div (\ ) = 9$.
8. $(\ ) \div 5 = 4$.
9. $(\ ) \div 5 = 9$.
10. $\frac{1}{5}$ of $(\ ) = 3$.
11. $\frac{1}{5}$ of $40 = (\ )$.

12. How many 5-yard lengths can be made from 45 yd. of cloth? from 35 yd.? from 25 yd.? from 60 yd.?

13. At 5¢ each, how many pencils can you buy for 35¢? for 45¢? for 15¢? for 50¢? for 60¢?

14. At 5¢ each, how many bottles of mucilage can you buy for 40¢? for 50¢? for 20¢? for 30¢? for 55¢?

15. If it is 40 ft. round a flower bed, and each side is 5 ft. long, how many sides are there?

LEARNING ABOUT SIX

All work oral

1. Add the columns of 6's, from one 6 to five 6's.

2. On the blackboard and on paper build more columns of 6's, until you have twelve 6's in the last column. How many columns are there?

3. Read the columns, thus: "One 6 is 6, two 6's are 12, three 6's are 18," and so on.

4. How many are five 6's? six 6's? seven 6's? eight 6's? eleven 6's?

5. Read and learn the table of 6's:

$1 \times 6 = 6$	$5 \times 6 = 30$	$9 \times 6 = 54$
$2 \times 6 = 12$	$6 \times 6 = 36$	$10 \times 6 = 60$
$3 \times 6 = 18$	$7 \times 6 = 42$	$11 \times 6 = 66$
$4 \times 6 = 24$	$8 \times 6 = 48$	$12 \times 6 = 72$

6. How many are 6×0? 0×6? 6×11? 6×12?

7. How many are $6 + 6 + 6 + 6 + 6$? 5×6?

8. State the value of each of the following:

6×1	6×8	6×4	6×3
6×5	6×7	6×2	6×9
1×6	8×6	4×6	9×6
5×6	7×6	2×6	0×6

State the value of each of the following:

9. $2 \times 6 + 1$. **11.** $3 \times 6 + 2$. **13.** $5 \times 6 + 1$.

10. $3 \times 6 + 1$. **12.** $4 \times 6 + 3$. **14.** $5 \times 6 + 2$.

DIVIDING BY SIX

Numbers 1 to 5, oral

1. How many 6's are there in 6? in 12? in 18? in 42?

2. State rapidly the results:

$54 \div 6$ $30 \div 6$ $48 \div 6$ $36 \div 6$ $\frac{1}{6}$ of 42

3. Read and learn this table:

$6 \div 6 = 1$	$30 \div 6 = 5$	$54 \div 6 = 9$
$12 \div 6 = 2$	$36 \div 6 = 6$	$60 \div 6 = 10$
$18 \div 6 = 3$	$42 \div 6 = 7$	$66 \div 6 = 11$
$24 \div 6 = 4$	$48 \div 6 = 8$	$72 \div 6 = 12$

4. State the value of each of the following:

5×6	7×6	9×6	$\frac{1}{6}$ of 48
6×5	6×7	6×9	$\frac{1}{6}$ of 18
$30 \div 6$	$42 \div 6$	$54 \div 6$	$\frac{1}{6}$ of 42
$30 \div 5$	$42 \div 7$	$54 \div 9$	$\frac{1}{6}$ of 24

5. If the pupils of a class of 36 march in rows of 6, how many rows are there?

6. Copy and complete: $72 \div (\quad) = 6$; $(\quad) \div 6 = 3$.

7. At 6¢ a yard, how many yards of braid can you buy for 24¢? for 30¢? for 66¢? for 12¢? for 36¢? for 72¢?

8. At 6¢ each, how many oranges can you buy for 48¢? for 54¢? for 60¢? for 36¢? for 72¢? for 66¢?

9. At 6¢ a box, how many boxes of matches can you buy for 54¢? for 36¢? for 42¢? for 72¢? for 30¢? for 24¢? for 12¢? for 48¢? for 60¢?

LEARNING ABOUT SEVEN

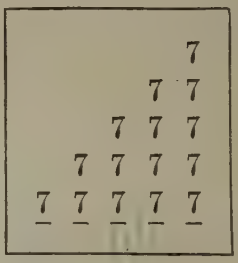
All work oral

1. Add the columns of 7's, from one 7 to five 7's.

2. On the blackboard and on paper build more columns of 7's, until you have twelve 7's in the last column. How many columns are there?

3. Read the columns, thus: "One 7 is 7, two 7's are 14," and so on.

4. How many are five 7's? six 7's? seven 7's? eight 7's? nine 7's? ten 7's? eleven 7's? twelve 7's?



5. Read and learn the table of 7's:

$1 \times 7 = 7$	$5 \times 7 = 35$	$9 \times 7 = 63$
$2 \times 7 = 14$	$6 \times 7 = 42$	$10 \times 7 = 70$
$3 \times 7 = 21$	$7 \times 7 = 49$	$11 \times 7 = 77$
$4 \times 7 = 28$	$8 \times 7 = 56$	$12 \times 7 = 84$

6. How many are 7×0? 0×7? 7×11? 7×12?

7. How many are $7+7+7+7+7+7+7$? What short way is there of finding the answer?

8. State the value of each of the following:

3×7	7×6	7×9	7×5
7×3	9×7	7×0	0×7
4×7	7×7	7×2	2×7
7×4	7×8	7×1	5×7

9. What is the cost of 7 school desks at \$4 each and a teacher's desk at \$7?

DIVIDING BY SEVEN

Numbers 1 to 5, oral

1. How many 7's are there in $7+7+7$? in 21?
2. How many 7's are there in 28? in 35? in 42?
3. State rapidly the results: $70 \div 7$, $63 \div 7$, $49 \div 7$.
4. Read and learn this table:

$7 \div 7 = 1$	$35 \div 7 = 5$	$63 \div 7 = 9$
$14 \div 7 = 2$	$42 \div 7 = 6$	$70 \div 7 = 10$
$21 \div 7 = 3$	$49 \div 7 = 7$	$77 \div 7 = 11$
$28 \div 7 = 4$	$56 \div 7 = 8$	$84 \div 7 = 12$

5. State the value of each of the following:

8×7	9×7	6×7	5×7
7×8	7×9	7×6	7×5
$56 \div 7$	$63 \div 7$	$\frac{1}{7}$ of 42	$\frac{1}{7}$ of 35
$56 \div 8$	$63 \div 9$	$\frac{1}{6}$ of 42	$\frac{1}{5}$ of 35

6. There are 63 children marching in rows of 7. How many rows are there?

7. An open trolley car with 7 cross seats will seat 42 persons. How many persons can sit on each cross seat?

8. Frances spent 72¢ for 6 yd. of ribbon. How much did she pay a yard?

9. Maude spent 84¢ for 7 yd. of ribbon. How much did she pay a yard?

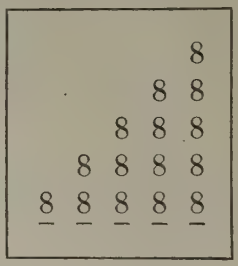
10. A dealer paid $77 for 7 tables. How much did he pay for each table?

LEARNING ABOUT EIGHT

All work oral

1. Add the columns of 8's, from one 8 to five 8's.

2. Build more columns of 8's, until you have twelve 8's in the last column. Then read the columns, thus: "One 8 is 8, two 8's are 16," and so on.



3. How many are five 8's? six 8's? seven 8's? eight 8's? nine 8's? ten 8's? eleven 8's? twelve 8's?

4. Read and learn the table of 8's:

$1 \times 8 = 8$	$5 \times 8 = 40$	$9 \times 8 = 72$
$2 \times 8 = 16$	$6 \times 8 = 48$	$10 \times 8 = 80$
$3 \times 8 = 24$	$7 \times 8 = 56$	$11 \times 8 = 88$
$4 \times 8 = 32$	$8 \times 8 = 64$	$12 \times 8 = 96$

5. How many are 8×0? 0×8? 8×11? 8×12?

6. How many are $8 + 8 + 8 + 8 + 8 + 8$? What is the short way of finding the answer?

7. State the value of each of the following:

5×8	8×2	7×8	8×9
8×5	8×0	8×6	8×8

8. At 8¢ each, how much will 9 melons cost?

9. At 8¢ each, how much will 8 pencils cost?

10. At 8 miles an hour, how far will a man drive a team of horses in 2 hours?

MULTIPLYING AND DIVIDING

Numbers 1 to 9, oral

State the value of each of the following:

1. $5 \times 8 + 4$. **3.** $8 \times 7 + 6$. **5.** $6 \times 8 + 2$.

2. $4 \times 8 + 3$. **4.** $2 \times 8 + 1$. **6.** $8 \times 2 + 1$.

7. How many 8's are there in 16? in 24? in 40?

8. State the value of each of the following:

$32 \div 8$ $40 \div 8$ $24 \div 8$ $80 \div 8$ $\frac{1}{8}$ of 16

9. Read and learn this table:

$8 \div 8 = 1$	$40 \div 8 = 5$	$72 \div 8 = 9$
$16 \div 8 = 2$	$48 \div 8 = 6$	$80 \div 8 = 10$
$24 \div 8 = 3$	$56 \div 8 = 7$	$88 \div 8 = 11$
$32 \div 8 = 4$	$64 \div 8 = 8$	$96 \div 8 = 12$

10. At \$8 each, how many rocking-chairs can you buy for \$48? for \$72? for \$56? for \$88? for \$96?

11. At 8¢ a pint, how many pints of milk can you buy for 64¢? for 72¢? for 16¢? for 32¢?

12. If there are 8 desks in each row and there are 32 desks in the room, how many rows are there?

13. If there are 24 pencils to be passed to the pupils seated in rows of 8, how many rows are there?

Copy and complete the following:

14. $96 \div 8 = (\ )$. **17.** $96 \div (\ ) = 12$. **20.** $\frac{1}{8}$ of $72 = (\ )$.

15. $(\ ) \div 8 = 11$. **18.** $48 \div 8 = (\ )$. **21.** $\frac{1}{8}$ of $64 = (\ )$.

16. $56 \div 8 = (\ )$. **19.** $(\ ) \div 8 = 12$. **22.** $\frac{1}{8}$ of $(\ ) = 11$.

LEARNING ABOUT NINE

Numbers 1 to 6, oral

1. State the sum of each of these columns of 9's, thus: 9, 18, and so on.

2. Count by 9's from 9 to 108.

3. How many 9's do you see in the column that makes 36? in the one that makes 45?

				9
			9	9
		9	9	9
	9	9	9	9
9	9	9	9	9

4. Read and learn the table of 9's:

$1 \times 9 = 9$	$5 \times 9 = 45$	$9 \times 9 = 81$
$2 \times 9 = 18$	$6 \times 9 = 54$	$10 \times 9 = 90$
$3 \times 9 = 27$	$7 \times 9 = 63$	$11 \times 9 = 99$
$4 \times 9 = 36$	$8 \times 9 = 72$	$12 \times 9 = 108$

5. How many are 9×0? 0×9? 0×0? 12×0?

6. State the value of each of the following:

9×3	9×5	9×7	9×1
9×6	9×0	8×9	7×9
9×2	9×8	9×9	9×4

7. Write twelve columns of 9's, as in Ex. 1 above, from one 9 to twelve 9's. Add each column.

8. A man earns \$9 a day. How much does he earn in 7 days? in 9 days? in 12 days?

9. A dealer sold 12 tables at \$8 apiece. How much did he receive for all the tables?

10. If you buy 9 oranges at 8¢ each, and 9 bananas at 6¢ each, how much do you pay for all?

MULTIPLYING AND DIVIDING

Numbers 1 to 7, oral

1. How many 9's are there in 18? in 27? in 36?

2. At \$9 each, how many coats can be bought for \$45? for \$54? for \$63? for \$99?

3. At \$9 each, how many dresses can be bought for \$27? for \$18? for \$36? for \$72? for \$108?

4. State the value of each of the following:

$18 \div 9$ $27 \div 9$ $36 \div 9$ $45 \div 9$ $\frac{1}{9}$ of 54

5. Read and learn this table:

$9 \div 9 = 1$	$45 \div 9 = 5$	$81 \div 9 = 9$
$18 \div 9 = 2$	$54 \div 9 = 6$	$90 \div 9 = 10$
$27 \div 9 = 3$	$63 \div 9 = 7$	$99 \div 9 = 11$
$36 \div 9 = 4$	$72 \div 9 = 8$	$108 \div 9 = 12$

6. There are 54 boys in a school, and the boys are divided into baseball nines. How many nines are there?

7. How many baseball teams, each made up of 9 boys, can be formed from 27 boys? from 63 boys?

Copy and complete the following:

8. $6 \times 9 + 5 = (\quad)$.

9. $7 \times 9 + 3 = (\quad)$.

10. $9 \times 9 + 7 = (\quad)$.

11. $5 \times 9 + 3 = (\quad)$.

12. $\frac{1}{9}$ of $72 = (\quad)$.

13. $\frac{1}{9}$ of $(\quad) = 12$.

14. Ralph bought 9 oranges at 7¢ each, and 4 oranges at 9¢ each. How much did he pay for all the oranges?

TENS, ELEVENS, AND TWELVES

All work oral

1. Count by 10's from one 10 to twelve 10's.

2. How many are three 10's? seven 10's?

3. Recite, "One 10 is 10, two 10's are 20," and so on to "twelve 10's are 120."

4. Read and learn the table of 10's:

$1 \times 10 = 10$	$5 \times 10 = 50$	$9 \times 10 = 90$
$2 \times 10 = 20$	$6 \times 10 = 60$	$10 \times 10 = 100$
$3 \times 10 = 30$	$7 \times 10 = 70$	$11 \times 10 = 110$
$4 \times 10 = 40$	$8 \times 10 = 80$	$12 \times 10 = 120$

5. What easy way do you see of multiplying 10 by any number? of multiplying any number by 10?

6. Read and learn the table of 11's:

$1 \times 11 = 11$	$5 \times 11 = 55$	$9 \times 11 = 99$
$2 \times 11 = 22$	$6 \times 11 = 66$	$10 \times 11 = 110$
$3 \times 11 = 33$	$7 \times 11 = 77$	$11 \times 11 = 121$
$4 \times 11 = 44$	$8 \times 11 = 88$	$12 \times 11 = 132$

7. Read and learn the table of 12's:

$1 \times 12 = 12$	$5 \times 12 = 60$	$9 \times 12 = 108$
$2 \times 12 = 24$	$6 \times 12 = 72$	$10 \times 12 = 120$
$3 \times 12 = 36$	$7 \times 12 = 84$	$11 \times 12 = 132$
$4 \times 12 = 48$	$8 \times 12 = 96$	$12 \times 12 = 144$

The pupil already knows all but three of the products in Exs. 6 and 7, having learned them in the preceding tables. This page, therefore, has only three essentially new products, 11×11, 12×11, and 12×12.

V. MEASURES AND FRACTIONS

MEASURING FRUIT AND GRAIN

1. Name some fruit that is sold by the quart.
2. Name some grain that is sold by the bushel.
3. Name the three measures in the picture.
4. Read and learn this table of dry measure:

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

5. What special name is given to a half of a quart?
6. What special name is given to an eighth of a peck?

Such work should be treated orally and made the basis of an impromptu class exercise. It is desirable to have the measures in class, where they can be seen and handled.

MEASURING LIQUIDS

1. Name some liquid that is sold by the pint.

2. What liquid is sold by the quart?

3. Do you know of anything that is usually sold by the gallon? If so, what is it?

4. Read and learn this table of liquid measure:

2 pints (pt.) = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

5. What special name is given to a quarter of a gallon?

6. What special name is given to a half of a quart?

7. What is an eighth of a gallon called?

8. In the above picture point to the pint, the quart, and the gallon.

See the note on page 85. If the measures are available, the table may be verified by pouring water from one measure to another.

LEARNING ABOUT ONE THIRD

Numbers 1 to 8, oral

1. The circle here shown has been divided into how many equal parts?

2. Each of these equal parts is called what part of the circle?

3. If a line is cut into three equal parts, each is what part of the line?

4. What is one of the three equal parts of anything called? What does $\frac{1}{3}$ of a circle mean?

5. One foot is what part of a yard?

6. What is meant by $\frac{1}{3}$ of a line? by $\frac{1}{3}$ of a dozen?

7. How much is $\frac{1}{3}$ of 3 in.? $\frac{1}{3}$ of 3 lb.?

8. How long is a line that is $\frac{1}{3}$ of 3 ft. long?

9. Draw a line 3 in. long and mark off $\frac{1}{3}$ of it.

10. Draw a line 6 in. long and mark off $\frac{1}{3}$ of it.

11. Draw a line 1 in. long. Then extend this line so that it is $\frac{1}{2}$ in. longer. Mark off $\frac{1}{3}$ of the whole line.

12. Here are 6 stars arranged in three equal groups. How many stars are $\frac{1}{3}$ of 6 stars?

* * *
* * *

13. Draw 9 stars and separate them into three equal groups. How many stars are $\frac{1}{3}$ of 9 stars?

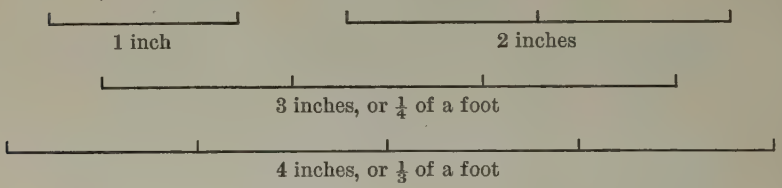
14. Draw 12 stars and separate them into two equal groups. How many stars are $\frac{1}{2}$ of 12 stars?

15. Draw 12 stars and separate them into three equal groups. How many stars are $\frac{1}{3}$ of 12 stars?

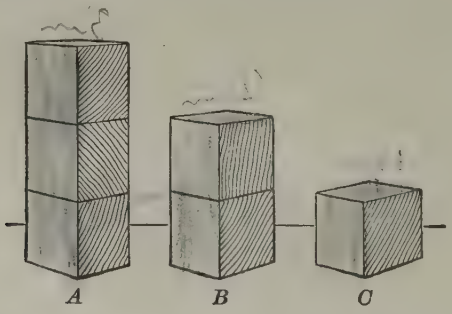
MEASURING WITH FRACTIONS

All work oral

1. When you measure your height, do you measure it in inches, or in feet, or in both feet and inches?



2. How many inches are there in a foot? in $\frac{1}{2}$ of a foot? in $\frac{1}{3}$ of a foot? in $\frac{1}{4}$ of a foot?



3. Which block is $\frac{1}{3}$ as high as block A?

4. Which block is $\frac{2}{3}$ as high as block A?

5. Block C is what part as high as block B?

This exercise is illustrative of the oral work that should be given to fix clearly the notions of $\frac{1}{3}$ and $\frac{2}{3}$. The pupil has already studied $\frac{3}{4}$ on page 40. If the class is ready for it, the teacher may show that $\frac{1}{3} + \frac{2}{3} = \frac{3}{3} = 1$, but this is not essential at present.

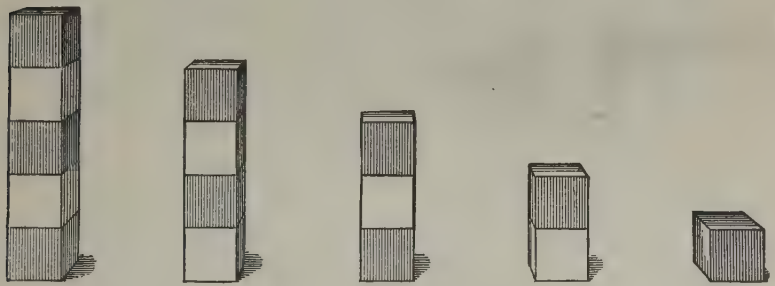
ANOTHER USE OF FRACTIONS

Numbers 1 to 5, oral

1. Block E is what part as large as block D?

2. Block E is what part as large as block C? as block B? as block A?

3. Block D is what part as large as block B? as block C? as block A?



4. Which block is $\frac{3}{4}$ as large as block B?

5. Which block is $1\frac{1}{4}$ times as large as block B?

The above questions are merely suggestive of the oral work that should be carried on with blocks, strips of paper, bundles of splints, and the like, until the idea of a fraction like $\frac{2}{5}$ is clear to the pupil.

6. Draw a line 5 in. long and a line $\frac{2}{5}$ as long.

7. Draw a line 10 in. long and a line $\frac{3}{5}$ as long.

8. Draw a line $2\frac{1}{2}$ in. long and a line $\frac{1}{5}$ as long.

9. Draw a line $\frac{4}{5}$ as long as a 5-inch line.

10. Draw a line $\frac{2}{5}$ as long as a $2\frac{1}{2}$-inch line.

LEARNING ABOUT SIXTHS

Numbers 1 to 6, oral

1. How many thirds of a circle in a circle?
2. How many sixths of a circle in a circle?

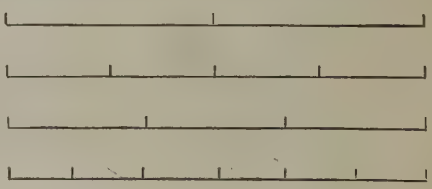
3. Kate gave $\frac{1}{6}$ of a pie to Frank, $\frac{1}{6}$ to May, and $\frac{1}{6}$ to Mabel. How many sixths did she give away?

4. Frank's mother gave him $\frac{1}{3}$ of a pie, and he gave $\frac{1}{2}$ of his piece to Rob. What part of the pie did Rob receive?

5. How many thirds of a circle are $\frac{2}{6}$ of the circle?

6. How many sixths of a circle are $\frac{2}{3}$ of the circle?

7. Copy this figure. Then copy and complete this statement: $\frac{2}{4}$ of the line is just as long as ( ) of the line.



Using the lines of Ex. 7, complete each of the following statements:

8. $\frac{2}{6}$ of the line is the same as ( ) of the line.
9. $\frac{4}{6}$ of the line is the same as ( ) of the line.
10. $\frac{3}{6}$ of the line is the same as ( ) of the line or as ( ) of the line.

PLAYING STORE

1. Martha is the storekeeper to-day. Joe buys 3 oranges at 7¢ each. How much must he pay?

2. Margaret buys 4 apples at 4¢ each. How much do all the apples cost?

3. Bessie buys 2 bananas at 4¢ each. She gives Martha 25¢. How much change is due her?

4. Fanny buys an orange for 7¢ and gives Martha 50¢. How much change is due her?

5. Martha takes in 52¢ for her store. How much more must she take in to make 75¢?

6. If Martha takes in 64¢ for her store, this is how much more than half a dollar? It is how much less than 75¢?

Use pencil and paper only when necessary.

PREPARING FOR THE PARTY

1. If you pay 60¢ for a tree and give the dealer 75¢, how much change is due?

2. If Ella buys 8 strings of tinsel at 12¢ a string, how much does the tinsel cost?

3. If Ella buys 12 candy canes at 8¢ each, how much do they cost?

4. Ella buys 9 colored balls at 7¢ each. How much does she pay for them?

5. If there are 24 candles on the tree and half of them are red, how many red candles are there?

6. If there are 12 children at the party and $\frac{1}{3}$ of them are boys, how many boys are there?

7. If there are 12 children at the party and $\frac{2}{3}$ of them are girls, how many girls are there?

8. How many are $\frac{1}{3}$ of 12 children and $\frac{2}{3}$ of 12 children?

PROBLEMS OF THE ORCHARD

1. Jack's father has an orchard with 8 rows of apple trees, 12 trees in each row. How many trees are there in the whole orchard?

2. Jack picked 2 bu. of apples from each of 12 apple trees. How many bushels did he pick in all?

3. Jack's father sold 12 bu. of apples at $2 a bushel. How much did he receive for the apples?

4. He paid Jack 5¢ a bushel for picking apples. After picking 12 bu. how much money had Jack earned?

5. Jack puts 30 apples in a layer at the bottom of a box, and 5 layers fill the box. Add, and find the number of apples needed to fill the box.

PROBLEMS WITHOUT NUMBERS

1. If you know the number of apples in one box and the number in another box, how do you find the number of apples in both boxes?

2. If you know the number of oranges in one box and the number in another box, how do you find how many more there are in one box than in the other box?

3. If you know the number of gallons of milk in a can, how do you find the number of quarts?

4. If you know the number of quarts of cream in a can, how do you find the number of pints?

5. If you know the number of pints of cream in a can, how do you find the number of quarts?

6. If you know the price of cloth by the yard, how do you find the cost of a certain number of yards?

7. When you buy something and pay the dealer more than it costs, how do you find how much change is due?

8. If you are told the number of trees in each row in an orchard and the number of rows, how do you find the number of trees in the orchard?

9. If you know the number of passengers in a trolley car and the fare paid by each, how do you find the amount paid by all?

10. If you know the number of pupils in each of two schools, how do you find the number in both schools?

11. If you know the number of feet in a piece of wire, how do you find the number of yards?

VI. MINIMUM ESSENTIALS

WRITTEN EXERCISE

1. Write in figures the number four hundred seventy.
2. Write in words the numbers 509, 590, 950, and 905.

Add the following:

3. 388	5. 668	7. 529	9. 279	11. 428
287	293	498	378	96
4. 348	6. 486	8. 389	10. 426	12. 405
293	273	96	377	371

Subtract the following and check each result:

13. 686	15. 729	17. 480	19. 721	21. 862
231	231	236	236	375
14. 626	16. 332	18. 731	20. 540	22. 820
169	74	227	268	329

Copy the following and write the results, the whole work taking 3 minutes or less:

23. 6×7.	30. $\frac{1}{2}$ of 24.	37. $7 \times 6 + 5$.
24. 7×8.	31. $\frac{1}{3}$ of 15.	38. $6 \times 3 + 2$.
25. 8×9.	32. $\frac{1}{4}$ of 20.	39. $9 \times 2 + 1$.
26. 9×7.	33. $\frac{1}{5}$ of 30.	40. $3 \times 5 + 2$.
27. 6×9.	34. $36 \div 4$.	41. $5 \times 2 + 1$.
28. 8×8.	35. $81 \div 9$.	42. $2 \times 5 + 1$.
29. 9×9.	36. $72 \div 8$.	43. $8 \times 3 + 2$.

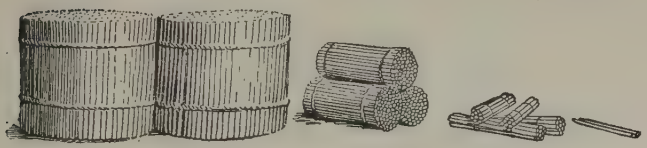
VII. LITTLE EXAMINATIONS

I.	1. $18 + 39$.	5. $28 \div 7$.	9. $\frac{1}{3}$ of 36.
	2. $50 - 14$.	6. 3×12.	10. $\frac{1}{4}$ of 36.
	3. XI = (?).	7. 7×11.	11. 5 qt. = (?) pt.
	4. $7 \times 6 + 2$.	8. $48 \div 4$.	12. 8 pt. = (?) qt.
II.	1. $27 + 95$.	5. $24 \div 3$.	9. $\frac{1}{2}$ of 24.
	2. $65 - 27$.	6. $24 \div 4$.	10. $\frac{1}{3}$ of 24.
	3. IX = (?).	7. 8×11.	11. $\frac{1}{4}$ of 32.
	4. $7 \times 8 + 6$.	8. 8×12.	12. 3 ft. = (?) in.
III.	1. $78 + 86$.	5. $36 \div 4$.	9. $\frac{1}{2}$ of 20.
	2. $91 - 74$.	6. $30 \div 3$.	10. $\frac{1}{3}$ of 30.
	3. VIII = (?).	7. 4×11.	11. $\frac{1}{4}$ of 28.
	4. $5 \times 7 + 4$.	8. 4×12.	12. 2 yd. = (?) ft.
IV.	1. $261 + 349$.	5. $32 \div 4$.	9. $\frac{1}{3}$ of 18.
	2. $352 - 175$.	6. $27 \div 3$.	10. $\frac{1}{6}$ of 18.
	3. VII = (?).	7. 5×11.	11. $\frac{1}{4}$ of 24.
	4. $9 \times 9 + 7$.	8. 8×12.	12. 6 ft. = (?) yd.
V.	1. $476 + 398$.	5. $16 \div 4$.	9. $\frac{1}{4}$ of 16.
	2. $957 - 849$.	6. $24 \div 2$.	10. $\frac{1}{8}$ of 16.
	3. 12×10.	7. $18 \div 3$.	11. $\frac{1}{7}$ of 21.
	4. 10×11.	8. 12×9.	12. 1 yd. = (?) in.

These Little Examinations at the close of each chapter furnish excellent review drill work. The time should be recorded for each, and the pupils should endeavor to improve their records. See page 46.

CHAPTER III

I. READING AND WRITING NUMBERS



2000 + 300 + 40 + 2

NUMBERS TO 10,000

All work oral

1. Ten 100's make *one thousand.* We write one thousand thus: 1000. Count by 1000's from 1000 to 10,000.

2. We read 2000 thus: "Two thousand." How do we read 3000? 4000? 5000? 9000? 10,000?

3. We read 2200 thus: "Twenty-two hundred," or, less commonly, "two thousand two hundred." How do we read 3200? 4800? 5600? 7500? 8700? 9600? 9900?

4. We read 2004 and 2745 thus: "Two thousand four" and "two thousand seven hundred forty-five." How do we read 3007? 3047? 3147? 5247?

A date like 1924 is usually read "Nineteen twenty-four." There is no uniformity in the use of a comma in a four-figure number, and it is correct to write either 4236 or 4,236.

READING AND WRITING NUMBERS

Numbers 1 to 40, oral

Read the following numbers:

1. 1000.	11. 3000.	21. 5000.	31. 7000.
2. 1100.	12. 3300.	22. 5005.	32. 7200.
3. 1120.	13. 3340.	23. 5050.	33. 7296.
4. 1125.	14. 3348.	24. 5055.	34. 8496.
5. 1335.	15. 3003.	25. 6000.	35. 8598.
6. 2000.	16. 4000.	26. 6600.	36. 9356.
7. 2200.	17. 4040.	27. 6606.	37. 9398.
8. 2260.	18. 4004.	28. 6666.	38. 9772.
9. 2265.	19. 4044.	29. 6980.	39. 9990.
10. 2479.	20. 4444.	30. 6989.	40. 9999.

Write the following numbers in figures:

41. One hundred one; two hundred two.
42. One thousand one; ten thousand.
43. Two thousand two hundred two.
44. Three thousand five hundred sixteen.
45. Three thousand six hundred nineteen.
46. Four thousand eight hundred sixty-eight.
47. Five thousand nine hundred fifty-nine.
48. Six thousand seven hundred eighty-nine.
49. Eight thousand eight hundred eighty-eight.
50. Nine thousand nine hundred nineteen.
51. Nine thousand nine hundred ninety-nine.

ROMAN NUMERALS

Numbers 1 to 5, oral

1. Read these numbers, which are found on the clock face:

III IX XII I VII IV XI V X VI

2. Tell the time when the minute hand points to XII and the hour hand points to IX; to XI; to II; to X; to XII; to IV, or IIII; to I; to VI; to VII.

3. Read and learn these numbers, which are often used in numbering the chapters of a book:

1 to 5:	I	II	III	IV	V
6 to 10:	VI	VII	VIII	IX	X
11 to 15:	XI	XII	XIII	XIV	XV
16 to 20:	XVI	XVII	XVIII	XIX	XX

4. When you have read through Chapter XVI in a book, how many chapters have you read?

5. When you have read Chapter VIII of a book and the last chapter is XIX, how many chapters have you to read?

6. Write in Roman numerals:

16 18 7 12 19 4 9 5 10

7. Write in our ordinary numerals:

VIII XII XIX XIV XVI VII XVII

8. Write the number of years of your age, both in ordinary numerals and in Roman numerals.

Writing Money. In writing dollars and cents we write

$2.35 for 2 dollars and 35 cents,

$5.05 for 5 dollars and 5 cents,

and $0.75, $.75, or 75¢ for 75 cents.

Write first the dollar sign ($), then the dollars, then a period (decimal point), and then the cents, being sure to use two figures to express the cents.

Both $0.75 and $.75 are correct. When written by itself, $0.75 is the safer, for the decimal point in $.75 is easily overlooked; but when written in a column, as in addition, there is no need for the 0 except at the top.

The teacher should explain that $17 and $17.00 mean the same thing, that $2.75 = 275¢, and that 110¢ = $1.10.

In addition and subtraction the dollar sign is written only before the top number and before the result.

The teacher should allow such forms as 75ct. and 75c. as well as 75¢, because they are in common use and the pupils should know them.

READING AND WRITING MONEY

Numbers 1 to 12, oral

Read the following:

1. $1.38.	**4.** $29.65.	**7.** $142.	**10.** $719.38.
2. $2.07.	**5.** $31.00.	**8.** $319.86.	**11.** $848.95.
3. $4.00.	**6.** $52.08.	**9.** $529.85.	**12.** $918.68.

Write in figures, with the proper signs for money:

13. 5 dollars.

14. 36 dollars.

15. 85 dollars.

16. 1 dollar and 50 cents.

17. 35 dollars and 9 cents.

18. 208 dollars and 25 cents.

II. ADDITION

Adding Long Columns. In adding long columns we may write the sum of each column separately. Business men often do this. We may add *up* the first time, and check the result by adding *down*. When you look at two figures, always think of the *sum* of the two numbers. Instead of saying "3 and 5 are 8," simply think "8."

When you look at the figures in units' column you should at once see the two 10's $(7 + 3)$ and $(3 + 5 + 2)$, and should write 20.

\$92
55
93
83
67
20
37
\$390

The two partial sums should be written only in the case of the addition of long columns. Encourage reasonable rapidity on the part of the pupils. In exercises like the following a time limit should be set for copying and adding. It is just as valuable an exercise to copy neatly and correctly as to add correctly.

An example involving the addition of numbers of three figures should be discussed by the teacher at the blackboard.

ADDING LONG COLUMNS

Copy the following and add:

1.	2.	3.	4.	5.	6.
65	42	79	62	40	\$60
29	73	81	83	98	28
72	45	37	84	36	33
89	40	54	65	42	56
36	68	80	75	76	58
34	22	47	67	59	87
50	37	63	45	49	68

WORKING IN A STORE

1. Fred works in a grocery store. He finds 196 oranges in one box and 164 in another box. How many oranges does he find in both boxes?

2. The grocer has Fred take the cans of fruit from the shelves so as to count them. He counted 78 cans of peaches, 94 cans of pears, 62 cans of plums, 84 cans of apples, and 109 cans of apricots. How many cans of fruit were there of all five kinds?

3. Fred arranged on the shelves some cakes of soap of different kinds. There were 168 cakes of one kind, 195 of another, 238 of a third kind, and 204 of a fourth. How many cakes of soap were there in all?

4. Fred polished the eating apples so that they would sell better. He polished 164 apples of one kind, 148 of another, 56 of a third kind, and 135 of a fourth. How many apples did he polish?

5. The grocer sent Fred to the bank with $65 on Monday, $85 on Tuesday, $70 on Wednesday, $96 on Thursday, $75 on Friday, and $98 on Saturday. How much money did Fred put in the bank that week?

6. The grocer had Fred charge up to new goods purchased $60 on Monday, $15 on Tuesday, $18 on Wednesday, $5 on Thursday, $14 on Friday, and $12 on Saturday. How much did Fred charge up that week?

Common expressions referring to bills, goods charged, deposits in a bank, and the like should be used informally, the teacher explaining them whenever necessary.

Addition of Dollars and Cents. Kate put \$3.25 in her bank in one month, \$2.45 the next month, and \$0.35 the first week of the following month. How much did she put in her bank in all?

We see that we must add \$3.25, \$2.45, and \$0.35.

We first write the numbers as here shown so that the decimal points are under one another.

\$3.25
2.45
.35
\$6.05

Then $5¢ + 5¢ + 5¢ = 15¢ = 1$ dime $+ 5¢$. We write the 5 in cents' column and then add the 1 to the dimes.

Then 1 dime + 3 dimes + 4 dimes + 2 dimes = 10 dimes = \$1 + 0 dimes. We write the 0 in dimes' column and add the 1 to the dollars.

Then \$1 + \$2 + \$3 = \$6. We write the 6 in dollars' column and put the decimal point under the decimal points.

The sum is \$6.05; so Kate has put \$6.05 in her bank.

In adding United States money, write the numbers with the decimal points in a column and add in the usual way.

ADDING MONEY

Copy the following and add, checking the work:

1. \$2.85	3. \$3.80	5. \$4.90	7. \$3.95	9. \$7.98
3.60	4.68	3.75	2.68	4.22
2.35	4.67	2.55	3.32	5.50
2. \$2.25	4. \$4.96	6. \$3.75	8. \$8.24	10. \$6.38
3.85	3.24	5.62	.74	.95
.25	.35	1.38	3.30	2.00

HELPING AT THE STORE

1. Edward helps in a grocery after school, and the grocer sometimes sets him at work to add the bills. Mrs. Smith bought groceries costing \$2.60, \$3.25, \$0.75, and \$0.84. Edward adds these amounts. What is their sum?

2. Edward finds that Mrs. Clark has bought groceries costing \$2.05, \$2.68, \$0.95, \$2.38, \$0.72, and \$2.35. How much does she owe?

The grocer gives Edward bills with the following items to add. Find the sum of each:

3.	4.	5.	6.	7.
\$2.48	\$2.28	\$3.15	\$2.45	\$2.28
1.06	.60	2.16	2.00	3.42
.45	3.35	.48	3.30	.36
.37	.62	2.28	.47	1.09
2.65	1.45	.64	1.09	.32

Edward finds that the bills are usually ruled, so that he does not have to write the dollar sign or the decimal point. He finds that the columns look as follows; add each bill:

8.

3	08
	25
	68
2	06
	74

9.

2	35
2	46
1	75
	49
	37

10.

1	42
4	00
	68
2	74
	90

11.

1	20
4	08
	45
	66
	72

12.

	49
2	40
	78
2	46
	82

III. SUBTRACTION

Subtraction of Dollars and Cents. 1. A man had \$8.32 and spent \$3.47 for a hat. How much money had he left?

We see that we must subtract \$3.47 from \$8.32.

We first write the numbers as here shown so that the decimal points are under one another.

We cannot take 7 from 2, so we take 1 ten from the 3 tens and put it with the 2, making 12.

$12 - 7 = 5$. We write the 5 under cents.

$12 - 4 = 8$. We write the 8 under dimes.

We now write the decimal point.

$7 - 3 = 4$. We write the 4 under dollars.

\$8.32
3.47
\$4.85

The difference is \$4.85, and so the man had \$4.85 left.

Check. \$4.85 + \$3.47 = \$8.32.

2. If Mr. Simpson has \$350 and spends \$276.75 of it for some cattle, how much money has he left?

We see that we must subtract \$276.75 from \$350.

$10 - 5 = 5$. We write the 5 under cents.

$9 - 7 = 2$. We write the 2 under dimes.

We now write the decimal point.

$9 - 6 = 3$. We write the 3 under dollars.

$14 - 7 = 7$. We write the 7 under tens of dollars.

$2 - 2 = 0$, so there are no hundreds of dollars.

\$350.00
276.75
\$73.25

The result is \$73.25, and so Mr. Simpson has \$73.25 left.

In subtracting United States money, write the numbers so that the decimal points are in a column and subtract in the usual way.

SUBTRACTING MONEY

1. If you have \$3.75 in your bank and spend \$0.80 of it, how much money have you left?

2. If you are sent to the store with \$5 and spend \$3.35 of it, how much money have you left?

3. If a man has \$375.40 in the bank and draws out \$139.75, how much money has he left?

4. A school spends \$432.80 for books and other supplies, \$348.75 being for books. How much does it spend for the other supplies?

Subtract, check the work, and time yourself:

5. \$86.26 35.37	11. \$95.38 19.86	17. \$86.20 42.89	23. \$34.38 15.60
6. \$98.70 37.94	12. \$80.43 76.58	18. \$95.23 28.86	24. \$34.42 8.20
7. \$27.92 6.27	13. \$80.00 32.38	19. \$71.40 37.56	25. \$50.00 9.75
8. \$34.00 .98	14. \$42.08 26.79	20. \$81.32 38.75	26. \$98.03 48.26
9. \$42.70 15.85	15. \$57.44 48.72	21. \$67.75 66.84	27. \$86.42 3.15
10. \$80.25 30.66	16. \$67.68 9.29	22. \$80.00 26.28	28. \$85.00 1.65

Subtracting Four-Figure Numbers. In one year there were 8989 persons in a certain village, and in the next year there were 9226. What was the gain?

9226
8989
237

$16 - 9 = 7$, and we write the 7 in units' column and take 1 from the 2, leaving 1.

$11 - 8 = 3$, and we write the 3 in tens' column and take 1 from the 2, leaving 1.

$11 - 9 = 2$, and we write the 2 in hundreds' column and take 1 from the 9, leaving 8.

$8 - 8 = 0$, so there is nothing more to write.

Therefore the gain was 237 persons.

Check. $237 + 8989 = 9226$, and so the work is correct.

DRILL WORK

Subtract, and check the work:

1. 9280 − 2280	**6.** 6378 − 3239	**11.** 5823 − 2416	**16.** 6376 − 2829	**21.** 9321 − 5638
2. 4160 − 1876	**7.** 3180 − 1491	**12.** 3140 − 1806	**17.** 8100 − 2409	**22.** 6000 − 2609
3. 8200 − 1796	**8.** 4000 − 837	**13.** 2010 − 679	**18.** 4030 − 1908	**23.** 5000 − 1008
4. 5872 − 5280	**9.** 6321 − 1784	**14.** 3000 − 2876	**19.** 8005 − 4683	**24.** 8642 − 8596
5. 6815 − 4276	**10.** 9238 − 5643	**15.** 5017 − 4982	**20.** 8761 − 5972	**25.** 5280 − 3652

Making Change. If you owe the grocer 35¢ and give him a 50-cent piece, he makes change by finding the amount, which, added to 35¢, makes 50¢. He does this by saying, "35 and **5** are 40, and **10** are 50," taking up 5¢ and 10¢ as he says this. He then gives you 15¢.

Toy money may be used at this time. Accustom the pupils first to add to the next larger quarter or half dollar, using as few coins as possible; then to the next dollar, using as few coins as possible. This is exactly the kind of work that we have to do mentally when we make purchases.

MAKING CHANGE

All work oral

1. Make change for 50¢, when you owe:

15¢ 20¢ 30¢ 35¢ 39¢ 41¢ 29¢

2. Make change for 25¢, when you owe:

12¢ 14¢ 15¢ 16¢ 17¢ 23¢ 18¢

3. Make change for $1, when you owe:

65¢ 75¢ 78¢ 82¢ 46¢ 31¢ 95¢

4. Rachel buys some ribbon for 38¢ and gives the dealer 50¢. How much change is due?

5. Mollie buys some cloth for $1.40. She gives the dealer a 2-dollar bill. How much change is due?

6. Henry buys a tennis racket for $2.35 and gives the dealer $5. How much change is due?

IV. MULTIPLICATION

How to Multiply. If you have 23 marbles and Will has three times as many, how many marbles has Will?

To multiply 23 by 3 we see that 3×3 units $= 9$ units, and we write the 9 below the line, in units' place.

Then 3×2 tens $= 6$ tens, and we write the 6 in tens' place.

The result is 69, and so Will has 69 marbles.

Multiplicand	23
Multiplier	3
Product	69

The teacher should again (see page 63) explain orally the terms "multiplicand," "multiplier," and "product." Pupils at this time need no formal definitions of these terms.

MULTIPLYING NUMBERS

1. If Joe has 12 marbles and Frank has four times as many, how many marbles has Frank?

2. If you read 21 pages in a book yesterday and three times as many pages to-day, how many pages did you read to-day?

Multiply the following:

3. 13	5. 31	7. 32	9. 43	11. 44	13. 42
2	2	2	2	2	2
4. 20	6. 21	8. 22	10. 11	12. 11	14. 23
3	3	4	5	6	3

Further Work in Multiplication. If there are 48 apple trees in each of 4 rows, how many trees are there in all?

We see that 4×8 units are 32 units. We write the 2 in units' place and add the 3 tens to the 4×4 tens, making 19 tens.

The product is 192; so there are 192 trees.

$$\begin{array}{r} 48 \\ \times\ 4 \\ \hline 192 \end{array}$$

The teacher will observe the great value of the carrying drill, which has been a feature of the preceding work. What has thus far been a kind of number game now becomes a valuable aid. In the above example we have $4 \times 4 + 3 = 19$ as the second process.

MULTIPLYING NUMBERS

1. How much must a dealer pay for 6 rocking-chairs at \$14 each?
2. How much will 7 tables cost at \$24 each?
3. How much will 3 books cost at 25¢ each?
4. Find the cost of 8 desks at \$16 each; at \$18 each.

Multiply the following:

5. $\begin{array}{r} 44 \\ \times\ 4 \end{array}$	9. $\begin{array}{r} 22 \\ \times\ 6 \end{array}$	13. $\begin{array}{r} 34 \\ \times\ 7 \end{array}$	17. $\begin{array}{r} 39 \\ \times\ 2 \end{array}$	21. $\begin{array}{r} 43 \\ \times\ 5 \end{array}$	25. $\begin{array}{r} 32 \\ \times\ 3 \end{array}$
6. $\begin{array}{r} 68 \\ \times\ 4 \end{array}$	10. $\begin{array}{r} 74 \\ \times\ 4 \end{array}$	14. $\begin{array}{r} 33 \\ \times\ 5 \end{array}$	18. $\begin{array}{r} 97 \\ \times\ 5 \end{array}$	22. $\begin{array}{r} 80 \\ \times\ 6 \end{array}$	26. $\begin{array}{r} 32 \\ \times\ 7 \end{array}$
7. $\begin{array}{r} 44 \\ \times\ 5 \end{array}$	11. $\begin{array}{r} 55 \\ \times\ 4 \end{array}$	15. $\begin{array}{r} 65 \\ \times\ 3 \end{array}$	19. $\begin{array}{r} 74 \\ \times\ 8 \end{array}$	23. $\begin{array}{r} 38 \\ \times\ 9 \end{array}$	27. $\begin{array}{r} 82 \\ \times\ 8 \end{array}$
8. $\begin{array}{r} 77 \\ \times\ 2 \end{array}$	12. $\begin{array}{r} 62 \\ \times\ 7 \end{array}$	16. $\begin{array}{r} 76 \\ \times\ 8 \end{array}$	20. $\begin{array}{r} 86 \\ \times\ 9 \end{array}$	24. $\begin{array}{r} 84 \\ \times\ 9 \end{array}$	28. $\begin{array}{r} 31 \\ \times\ 8 \end{array}$

NUMBERS USED IN PLAY

1. If each of these three boys has 26 marbles, how many marbles have they in all?

2. If each of the three boys should buy 36 more marbles, how many more marbles would these boys have together?

3. If each of the three boys has 38 marbles, how many marbles do they all have?

4. If Fred's score is 46 and your score is twice as much, what is your score?

5. If each of five boys has 2 doz. marbles, how many marbles does each have? How many marbles have the five boys all together?

6. If the score in a certain game is 9, 16, 8, 27, 4, 38, and 17, how much is the total score?

Multiplying Dollars and Cents. 1. If a bookseller sells 9 books at \$1.35 each, how much money does he receive?

We see that we must multiply \$1.35 by 9.

\$1.35
9
\$12.15

We first see that $9 \times 5¢ = 45¢$, or 4 dimes and 5 cents. We write the 5 in cents' place and add the 4 to the dimes.

Then $9 \times 3 + 4 = 31$; that is, 9×3 dimes = 27 dimes, and 27 dimes + 4 dimes = 31 dimes, or \$3.10. We write the 1 in dimes' place and add the 3 to the dollars.

We then write the decimal point, to separate the dollars from the dimes.

Then $9 \times 1 + 3 = 12$; that is, $9 \times \$1 = \$9$, and $\$9 + \$3 = \$12$. We write the 12 to the left of the decimal point.

The product is \$12.15, and so the bookseller receives \$12.15 for the 9 books.

2. If the food that you eat for breakfast costs $15¢$ a day, how much does it cost each week?

There are 7 days in a week, and so we see that we must multiply \$0.15 by 7.

\$0.15
7
\$1.05

We see that $7 \times 5¢ = 35¢$, and we write the 5 in cents' place and add the 3 to the dimes.

Then $7 \times 1 + 3 = 10$; that is, 7×1 dime = 7 dimes, and 7 dimes + 3 dimes = 10 dimes, or \$1. We write the 0 in dimes' place and the 1 in dollars' place.

The product is \$1.05, the cost of the food.

In multiplying United States money, multiply as with other numbers and place the decimal point in the product below the decimal point in the multiplicand.

BUYING AT THE STORE

1. Clara bought 2 pairs of shoes at \$3.75 a pair. How much did the shoes cost her?

2. The baseball nine in our school bought 9 sweaters at \$3.25 each. How much did all the sweaters cost?

3. Some Boy Scouts bought 8 khaki suits at \$3.60 each. How much did they pay for all the suits?

4. Grace buys 7 yd. of cloth at 68¢ a yard. How much must she pay?

5. Kate buys 3 neckties for her brothers, paying 75¢ for each. How much do they all cost?

6. A baseball nine bought 9 suits at \$4.80 each. How much did all the suits cost?

7. The boys in a school bought 4 footballs at \$3.25 each. How much did they pay for all the footballs?

8. Ruth's father bought 2 rugs for his cottage, paying \$22.75 for each. How much did he pay for both?

9. Ruth's mother bought 6 yd. of velvet at \$6.35 a yard. How much did she pay for the velvet?

10. Make and solve a problem like Ex. 9.

Copy and multiply the following:

11. \$7.38 × 7	13. \$19.59 × 8	15. \$39.86 × 9	17. \$59.75 × 8
12. \$8.35 × 5	14. \$20.45 × 6	16. \$49.85 × 8	18. \$85.28 × 7

Multiplying by Tens. *To multiply by 10, annex a zero. If there is a decimal point, move it one place to the right.*

Thus $10 \times 75 = 750$, and $10 \times \$7.50 = \$75.00$.

The result of both $10 \times \$3$ and $10 \times \$3.00$ is \$30. We may write this as \$30, or as \$30.00. The product of $10 \times \$1.25$ is \$12.50, not \$12.5, it being the custom to put a zero at the right in such a case.

To multiply by 100, annex two zeros. Move any decimal point two places to the right.

To multiply by 20, multiply by 2 and annex a zero.

To multiply by 200, multiply by 2 and annex two zeros.

25	32
20	300
500	9600

We write the numbers and express the work as shown above in the multiplication of 25 by 20 and of 32 by 300.

BUYING TOYS

All work oral

1. Richard buys 10 marbles at 2¢ each. How much does he pay for the marbles?

2. Fred buys 4 toy sailboats at 10¢ each. How much do the sailboats cost him?

3. Ruth buys 2 dolls at 20¢ each. Find the cost.

4. Tom buys 2 drums at 60¢ each, one for himself and one for George. How much do they both cost?

5. What is the shortest way you see of multiplying 2 by 10? 10 by 4? 20 by 2? 60 by 2?

6. Multiply by 10: 8, 6, 9, 15, 21, 25, 30, 85, and 100.

MAKING PURCHASES

1. How much will 10 doz. pencils cost at 50¢ a dozen? at 56¢ a dozen? at 62¢ a dozen?

2. How much will 10 boxes of crayons cost at 45¢ a box? at 48¢ a box? at 53¢ a box?

3. At 20¢ apiece, how much will 5 blackboard pointers cost? How much will 8 pointers cost?

4. At 10¢ a small package, how much will half a dozen small packages of pens cost?

5. If an arithmetic costs 35¢, how much must be paid for 10 arithmetics? for 4 arithmetics?

6. If a book costs $1.25, how much must be paid for 10 such books? for 20 such books? for 30 such books?

7. At $16.75 each, how much must a dealer pay for 10 suits of boys' clothes? for 30 suits?

8. At $68.25 each, how much must a dealer pay for 10 bedroom sets? for 30 sets? for 50 sets?

9. At $82.50 an acre, how much must a farmer pay for 10 acres of land? for 30 acres? for 60 acres?

10. At $85.50 each, how much must a furniture dealer pay for 10 dining-room sets? for 20 sets? for 50 sets?

11. At $37.75 each, how much must a dealer pay for 10 office desks? for 20 desks? for 40 desks?

12. At $135 each, how much must a dealer pay for 10 Texas ponies? for 20 Texas ponies?

On this page the teacher should ask the class to solve each problem orally if possible; otherwise to use pencil and paper.

Two-Figure Multiplier. In a parade on the Fourth of July there were 16 children in a row and there were 35 rows. How many children marched in the parade?

We see that there were 35×16 children.

The product of 35×16 is the same as the product of 16×35, and it is easier to multiply 35 by 16.

We first multiply 35 by 6, the product being 210.

We then multiply 35 by 1 ten, the product being 35 tens. We write this so that the 5 is in tens' place.

Adding, the product is 560; so there were 560 children.

$$\begin{array}{r} 35 \\ 16 \\ \hline 210 \\ 35 \\ \hline 560 \end{array}$$

MARCHING ON PARADE

1. In a parade there were 14 children in a row and there were 28 rows. How many children were there in the parade?

2. The Boy Scouts in a city marched on the drill grounds. There were 24 boys in a row and there were 26 rows. How many boys were there in all?

3. In a large parade in a city there were 38 rows of girls in the Red Cross section, 24 girls in a row. How many girls were there in all?

4. In a drill of soldiers there were 48 in each row and there were 36 rows. How many soldiers were there?

Multiply the following:

5. 38×49. 6. 27×63. 7. 42×95. 8. 89×31.

Multiplying Dollars and Cents. Among the goods bought by a merchant was a roll of cloth. There were 54 yd. costing $2.75 a yard. How much did the roll of cloth cost?

One yard cost $2.75, and so 54 yd. cost 54 times as much.

We multiply in the usual way, first by 4 units and then by 5 tens.

In the product we place the decimal point between dollars and dimes.

The product is $148.50.

So the 54 yd. of cloth cost $148.50.

$$\begin{array}{r} \$2.75 \\ 54 \\ \hline 1100 \\ 1375 \\ \hline \$148.50 \end{array}$$

MULTIPLYING MONEY

1. At $32 a dozen, how much will 24 doz. knives cost?

2. At $48 a dozen, how much must a dealer pay for 26 doz. glass vases? for 15 doz. vases?

3. At $16 each, how much will 16 armchairs cost? What will be the cost of 25 armchairs? of 38 armchairs?

Multiply the following:

4. $6.85 by 15.
5. $8.09 by 18.
6. $4.82 by 28.
7. $3.89 by 19.
8. $0.68 by 83.
9. $2.23 by 22.
10. $3.19 by 34.
11. $6.42 by 39.
12. $5.80 by 38.
13. $7.60 by 62.
14. $8.26 by 32.
15. $9.96 by 48.
16. $8.38 by 49.
17. $3.75 by 76.
18. $63 \times \$0.78$.
19. $43 \times \$8.56$.
20. $62 \times \$3.96$.
21. $58 \times \$4.85$.
22. $72 \times \$5.75$.
23. $37 \times \$0.29$.
24. $48 \times \$9.75$.

DRILL WORK

In this exercise in multiplication see how large a score you can make in five minutes, counting every correct result 1, and subtracting 2 for every incorrect result:

1. \$3.50 × 21	5. \$4.68 × 22	9. \$5.80 × 33	13. \$22.50 × 54	17. \$37.68 × 20
2. \$6.60 × 24	6. \$9.96 × 28	10. \$6.98 × 35	14. \$23.85 × 84	18. \$62.95 × 30
3. \$7.80 × 65	7. \$6.34 × 37	11. \$9.75 × 43	15. \$58.70 × 93	19. \$99.99 × 90
4. \$6.75 × 45	8. \$7.39 × 49	12. \$9.87 × 98	16. \$63.85 × 82	20. \$52.65 × 60

21. A clothing dealer bought 64 suits of clothes at \$23.75 each. How much did he pay for the lot?

22. A dealer bought 18 automobiles at \$538.50 each. How much did he pay for the lot?

Multiply the following:

23. \$125.35 × 43	26. \$378.05 × 19	29. \$262.78 × 34	32. \$328.86 × 20
24. \$109.68 × 56	27. \$307.64 × 29	30. \$226.46 × 38	33. \$100.08 × 90
25. \$204.55 × 24	28. \$107.98 × 68	31. \$125.75 × 32	34. \$212.15 × 60

V. DIVISION

NEED FOR DIVISION

All work oral

1. How much is $\frac{1}{2}$ of $4¢$? How much is $4¢ \div 2$?

2. How much is $\frac{1}{2}$ of 8 in., or 8 in. $\div 2$?

3. If Kate has $36¢$ in her bank and spends one fourth of it, how much money does she spend?

4. If Ruth wishes to buy $\frac{1}{2}$ of a yard of cloth that costs $40¢$ a yard, how much money must she spend?

5. Alice buys 20 buttons and uses one fourth of them. How many does she use? How do you find the answer?

6. If Sarah has 24 hooks and eyes and uses one fourth of them, how many hooks and eyes does she use?

7. Emily bought 18 buttons and used half of them. How many buttons did she use and how many were left?

8. If Lena has 28 in. of ribbon and cuts it into pieces that are 7 in. long, how many pieces will she have? How do you find this number?

9. If Anna has 84 in. of ribbon and cuts it into pieces that are 7 in. long, how do you find the number of pieces? Can you find this number without pencil and paper? Can you see how to find it with such help?

Teachers will at once see that this exercise is intended to lead up to the necessity for knowing more about division. Ex. 9 should lead the pupil to see that he must now learn something new. If any pupils can solve the problem already, the teacher should make one that they cannot easily solve. In this way the necessity for further study of division will be seen.

How to Divide. There are 48 pupils in a class and they march in groups of 2. How many groups are there?

We see that we must find the number of 2's in 48.

To divide 48 by 2 we write the numbers as here shown. Then 4 tens ÷ 2 = 2 tens, and we write the 2 below the line in tens' place.

Then 8 units ÷ 2 = 4 units, and we write the 4 in units' place.

Divisor = 2)48 = Dividend
24 = Quotient

The quotient is 24, and so there are 24 groups.

Check. Since 2 × 24 = 48, the work is correct.

DIVIDING NUMBERS

Numbers 1 to 3, oral

1. If I divide 46 by 2, what is the first figure in the quotient? What is the second figure? What is the quotient?

2. If I divide 40 by 2, what is the first figure in the quotient? What is the second figure? What is the quotient?

3. There are 36 pupils in a room and they march in groups of 3. How many groups are there?

The above exercises should be worked out on the blackboard and simple problems relating to the class should be made by the pupils.

If necessary, the teacher should again (see page 66) explain orally the terms "dividend," "divisor," and "quotient."

Divide the following:

4. 44 ÷ 2.
5. 42 ÷ 2.
6. 39 ÷ 3.
7. 66 ÷ 3.
8. 48 ÷ 4.
9. 55 ÷ 5.
10. 60 ÷ 6.
11. 77 ÷ 7.

Further Work in Division. If one orange costs 6¢, how many oranges can you buy with 84¢?

We must find how many 6's there are in 84, for we can buy 1 orange for every 6¢.

$$6\overline{)84}\quad 14$$

In dividing 84 by 6 we see that we have 8 tens ÷ 6 = 1 ten, with 2 tens left over.

We write the 1 in tens' place in the quotient.

2 tens + 4 units = 24 units, which is to be divided by 6.

24 units ÷ 6 = 4 units. We write this in units' place.

The quotient is 14, and so you can buy 14 oranges.

DIVIDING NUMBERS

1. There are 92 apple trees in 4 equal rows. How many apple trees are there in each row?

2. At 6¢ each, how many pencils can you buy with 72¢? with 78¢? with 90¢? with 96¢?

3. At 5¢ each, how many bananas can you buy with 70¢? with 80¢? with 85¢? with 95¢?

4. Divide by 2; that is, find $\frac{1}{2}$ of:

30 36 54 56 72 74 78 98

5. Divide by 3; that is, find $\frac{1}{3}$ of:

24 42 57 51 48 81 84 87

6. Divide by 4; that is, find $\frac{1}{4}$ of:

52 68 64 92 96 56 60 76

Find the value of each of the following:

7. $\frac{1}{5}$ of 65. 8. $\frac{1}{6}$ of 84. 9. $\frac{1}{8}$ of 96. 10. $\frac{1}{7}$ of 84.

Further Work in Division. A city school has 864 pupils, and half of them are boys. How many are boys?

We divide 864 by 2 like this:

Dividing hundreds, $8 \div 2 = 4$.
Dividing tens, $6 \div 2 = 3$.
Dividing units, $4 \div 2 = 2$.

$$2\overline{)864}\quad 432$$

The quotient is 432, and so there are 432 boys.

Check. $2 \times 432 = 864$.

In explaining this process at the blackboard the teacher should also consider cases like $804 \div 2$ and $860 \div 2$.

DIVIDING NUMBERS

1. In a city school of 369 pupils, one third attend a school ball game. How many attend the game?

2. In a city school of 707 pupils, one seventh are in Grade III. How many are in Grade III?

3. Divide 868 by 2; then, in the same way, divide 8684 by 2 and divide 8686 by 2.

Divide the following:

4. $222 \div 2$.
5. $220 \div 2$.
6. $202 \div 2$.
7. $369 \div 3$.
8. $396 \div 3$.
9. $390 \div 3$.
10. $309 \div 3$.
11. $400 \div 4$.
12. $480 \div 4$.
13. $408 \div 4$.
14. $4848 \div 4$.
15. $4048 \div 4$.
16. $4808 \div 4$.
17. $8004 \div 4$.
18. $500 \div 5$.
19. $505 \div 5$.
20. $660 \div 6$.
21. $6606 \div 6$.
22. $7070 \div 7$.
23. $8008 \div 8$.
24. $9909 \div 9$.

Further Work in Division. A dealer buys 7 sets of furniture for $441. What is the average price of a set?

We see that each set costs $441 \div 7$.

$$7)\overline{441}\quad 63$$

We see that 7 is not contained in 4, so we take 44 and divide it by 7.

We know that $6 \times 7 = 42$, and so we see that $44 \div 7 = 6$, with a remainder of 2. Since we have divided 44 tens, we write the 6 in tens' place.

The remainder, 2, is tens. Then 2 tens $+ 1 = 21$, and $21 \div 7 = 3$. We write the 3 in units' place.

So the average price is $63.

The word "average" has here been introduced in a natural way, it being left for the teacher to explain as may be necessary. Illustrate by such cases as the average height of the pupils, their average weight, and their average age in months.

The teacher may ask the pupils to place the dollar sign before 441 and 63; but the business man would not do this in such a case. The fact that $\$6 \div \$2 = 3$ and $\$6 \div 2 = \$3$ makes the use of labels in division very difficult for the pupils to understand as early in the work as this.

DIVIDING NUMBERS

1. Six boys in a class together weigh 318 lb. What is their average weight?

2. Nine girls in a class together weigh 432 lb. What is their average weight?

Divide the following:

3. $658 \div 7$.
4. $972 \div 2$.
5. $726 \div 6$.
6. $567 \div 7$.
7. $204 \div 2$.
8. $420 \div 4$.
9. $1202 \div 2$.
10. $4203 \div 3$.

Remainder in Division. If you have 38¢, how many oranges can you buy at 5¢ each, and how much money will you have left?

We know that 7 fives are 35, so $38 \div 5 = 7$, and there is 3 left over.

So we see that we can buy 7 oranges, and there will be 3¢ left over.

$$5\overline{)38}\quad 7 \text{ remainder}$$

We say that 38 is not exactly divisible by 5, and that the quotient is 7 and the *remainder* is 3.

If there is no remainder, the division is said to be *exact*.

REMAINDER IN DIVISION

Numbers 1 to 8, oral

State rapidly the quotients and remainders:

1. $14 \div 3$.	**3.** $34 \div 3$.	**5.** $43 \div 4$.	**7.** $41 \div 7$.
2. $18 \div 4$.	**4.** $16 \div 3$.	**6.** $26 \div 5$.	**8.** $47 \div 8$.

9. At 5¢ each, how many oranges can you buy with 69¢, and how much money will you have left?

10. At 9¢ a pound, how many pounds of sugar can you buy with 56¢, and how much money will you have left?

11. At 3¢ each, how many postage stamps can you buy with 35¢, and how much money will you have left?

Divide, giving the quotients and remainders, if any:

12. $45 \div 2$.	**15.** $67 \div 5$.	**18.** $63 \div 8$.	**21.** $381 \div 2$.
13. $35 \div 3$.	**16.** $34 \div 6$.	**19.** $64 \div 9$.	**22.** $492 \div 3$.
14. $68 \div 4$.	**17.** $94 \div 7$.	**20.** $95 \div 9$.	**23.** $8167 \div 5$.

VI. MEASURES AND FRACTIONS

LEARNING ABOUT WEIGHT

All work oral

1. If you put a pound weight on one side of the scales, how many ounce weights must you put on the other side to balance the pound weight?

2. Then how many ounces make a pound? Then 1 ounce is what part of a pound?

If there are scales in the school, children should weigh various objects, and also find that 16 ounces = 1 pound. Children sometimes make bags of different sizes, putting in enough sand to make them weigh 1 lb., $\frac{1}{2}$ lb., and $\frac{1}{4}$ lb. The weights are then told, the children's eyes being closed.

3. Read and learn this table of weight:

16 ounces (oz.) = 1 pound (lb.)

4. If you buy $\frac{1}{2}$ lb. of cheese, how many ounces of cheese do you buy?

5. The average height and weight of the children in a certain school was found to be as follows:

Age	Height		Weight	
	Boys	Girls	Boys	Girls
7 years	48 in.	47 in.	51 lb.	48 lb.
8 years	50 in.	49 in.	55 lb.	51 lb.
9 years	52 in.	51 in.	60 lb.	57 lb.

Compare your height and weight with these averages.

BUYING AT THE GROCER'S

Numbers 1 to 6, oral

1. If you ask the grocer for $\frac{1}{2}$ lb. of cheese, he will cut off a piece that weighs as near $\frac{1}{2}$ lb. as he can guess. Suppose that it is 6 oz. How much more or how much less is this than $\frac{1}{2}$ lb.?

2. If you wish 1 lb. of butter and the grocer cuts off 14 oz., how much does it lack of being 1 lb.?

3. At 40¢ a pound, how much will $\frac{1}{2}$ lb. of butter cost? How much will $\frac{1}{4}$ lb. cost?

4. If you buy $\frac{1}{4}$ lb. of butter, how many ounces do you buy? If you buy $1\frac{1}{4}$ lb., how many ounces do you buy?

5. State the number of ounces in $\frac{1}{2}$ lb., $\frac{1}{4}$ lb., and $\frac{1}{8}$ lb.

6. Suppose that you buy 4 oz. of allspice, what part of a pound do you buy?

7. How many ounces are there in 2 lb.?

8. Find the number of ounces in $\frac{3}{4}$ lb. by multiplying the number of ounces in $\frac{1}{4}$ lb. by 3.

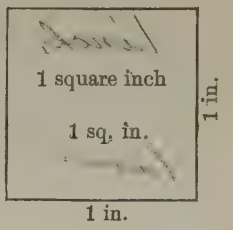
9. Find the number of ounces in $1\frac{1}{2}$ lb. by adding the number of ounces in 1 lb. to the number in $\frac{1}{2}$ lb.

10. How many ounces are there in $1\frac{3}{4}$ lb.?

11. If you buy 2 lb. 4 oz. of butter, you buy 2 lb. and what part of a pound?

12. If you ask for 1 lb. of cheese and the grocer weighs a piece and says that it weighs 20 oz., he gives you how many ounces more than you ask for?

Area of a Square or Rectangle. A square that is 1 in. on a side is 1 inch square. The *area* of such a square is 1 square inch.



A square that is 1 ft. on a side is 1 foot square, and the area of such a square is 1 square foot.

If a rectangle is 4 ft. long and 2 ft. wide, its area is 8 square feet. There are 2 rows, with 4 square feet in a row; that is, there are 2×4 square feet. We say that such a rectangle is 2 ft. by 4 ft.

Square Measure. In square measure we use this table:

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)

A rectangle that is 3 ft. wide and 6 ft. long has an area of 18 sq. ft., for 3×6 sq. ft. $= 18$ sq. ft.

It should be noticed that a circle, rectangle, or any other figure of this kind may have an *area* of 1 square inch. An inch square is a square, but a square inch is an area.

The inch square and foot square should be drawn on the blackboard, and the idea of *area* should be made clear by numerous simple illustrations like the ones given above. The pupils should ascertain the number of square inches in a square foot and the number of square feet in a square yard, thus verifying the table given above. Such common measures as the mile and acre may be mentioned and used, but it is not necessary at present to give their precise measurements.

The pupils should measure the schoolroom floor and find its area in square feet and in square yards. For present purposes it will suffice to carry such measurements to the nearest square foot or square yard.

FINDING AREAS

Numbers 1 to 18, oral

1. The top of a box is a rectangle 2 in. wide and 4 in. long. What is the area?

2. A sheet of paper is 4 in. by 6 in. What is the area?

3. A pane of glass is 8 in. by 10 in. What is the area?

4. The top of a desk is 18 in. long and 10 in. wide. What is the area?

5. A schoolroom is 10 yd. long and 8 yd. wide. What is the area of the floor?

6. The corridor in a schoolhouse is 40 ft. long and 8 ft. wide. How many square feet are there in the floor?

Find the area of each of the following rectangles:

7. 3 in. by 7 in.
8. 4 in. by 6 in.
9. 5 in. by 7 in.
10. 6 in. by 9 in.
11. 8 in. by 8 in.
12. 7 in. by 9 in.
13. 8 in. by 9 in.
14. 9 in. by 9 in.
15. 10 ft. by 12 ft.
16. 10 ft. by 16 ft.
17. 6 yd. by 10 yd.
18. 11 yd. by 12 yd.

Practice should be given in estimating lengths and areas, as of the blackboard and walls of the room.

19. Draw a yard square, representing 1 yd. by 1 in. This is called drawing it to the *scale* of 1 in. to 1 yd.

20. Draw a foot square to the scale of 3 in. to 1 ft.

21. If a rectangle is 3 in. long and 2 in. wide, how many square inches has it? Draw the figure.

22. If a schoolroom is 14 yd. long and 9 yd. wide, how many square yards are there in the floor?

MEASURING AND DRAWING

1. Measure the length and the width of a page of your arithmetic, each to the nearest inch. The page contains how many square inches?

2. Measure the length and the width of the top of your desk, each to the nearest inch. Find the area.

3. Measuring each side to the nearest inch, find the sum of the four sides of the top of your desk.

While it is desirable to avoid unnecessarily long words at this time, the teacher may explain the word "perimeter" if desired, using it in place of "sum of all the sides."

4. Find the length, width, area, and sum of the four sides of a page of your reader.

5. Draw a rectangle 6 in. long and 4 in. wide. Find the area and the sum of the four sides.

6. Draw a rectangle one half as long and one half as wide as the rectangle in Ex. 5. Find the area.

7. Find the area and the sum of the four sides of a rectangle 10 ft. long and 8 ft. wide.

8. A square flower bed 8 yd. on a side contains how many square yards?

9. Draw a 2-inch square. Draw a 4-inch square. The 2-inch square equals what part of the 4-inch square? Find the area and the sum of all the sides of the 2-inch square and also of the 4-inch square.

10. Make and solve a problem about measuring and finding the area of some surface in your schoolroom.

NEED FOR FRACTIONS

1. Alice is making some doll's clothes for her sister's doll. She has a piece of ribbon 20 in. long and uses $\frac{1}{4}$ of it. How many inches of ribbon does she use?

2. If Alice had used $\frac{1}{2}$ of the 20 in. of ribbon, how many inches of ribbon would she have used?

3. If Alice had used $\frac{3}{4}$ of the 20 in. of ribbon, how many inches of ribbon would she have used?

4. How do you find $\frac{1}{4}$ of a number? How do you find $\frac{3}{4}$ of a number?

5. Alice's mother has 24 yd. of calico, and she tells Alice that she can have $\frac{1}{8}$ of it. How many yards does she let Alice have?

6. Can you tell me how many yards Alice's mother had left after she gave Alice $\frac{1}{8}$ of the 24 yd.? How do you find this?

7. How do you find $\frac{1}{8}$ of a number? After you have found $\frac{1}{8}$ of a number, how do you find $\frac{3}{8}$ of the number? How do you find $1\frac{3}{8}$ times the number?

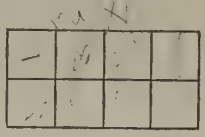
8. How do you find $\frac{1}{3}$ of a number? After this has been found, how do you find $\frac{2}{3}$ of the number? How do you then find $1\frac{2}{3}$ times the number?

The pupil is now beginning the study of harder fractions, and he should be led to see the need for the work. It is not necessary that he should be able to answer all of these questions without using pencil and paper; indeed, it is better that he should not answer them too readily, if at all. The important thing is to let the pupil see the necessity of further work in fractions. In Exs. 3, 7, and 8 the teacher should use objects, if necessary, to illustrate each point.

FINDING FOURTHS

Numbers 1 to 6, oral

1. Here is a rectangle made of 8 squares. How many squares in $\frac{1}{4}$ of the rectangle?



2. If one fourth of the rectangle contains 2 squares, three fourths of the rectangle contains how many squares?

3. To find $\frac{3}{4}$ of 8 squares we first find $\frac{1}{4}$ of 8 squares and then multiply by what number?

4. Find $\frac{1}{4}$ of 4 in. and then $\frac{3}{4}$ of 4 in.; $\frac{3}{4}$ of 16 in.

5. How many inches are there in $\frac{3}{4}$ of a foot?

6. How do you find $\frac{3}{4}$ of a number?

7. Find $\frac{1}{4}$ of 48 ft. Then multiply the result by 3 and so find $\frac{3}{4}$ of 48 ft.

8. Find $\frac{1}{4}$ of 72 in. Then find $\frac{3}{4}$ of 72 in.

9. Find $\frac{1}{4}$ of 100 ft. Then find $\frac{3}{4}$ of 100 ft.

Find $\frac{1}{4}$ and also $\frac{3}{4}$ of each of the following:

10. 96 ft.	14. 128 sq. in.	18. 64 sq. yd.
11. 104 in.	15. 144 sq. in.	19. 640 sq. yd.
12. 168 yd.	16. 176 sq. ft.	20. 600 sq. ft.
13. 324 yd.	17. 248 sq. ft.	21. 800 sq. yd.

22. How many square inches are there in $\frac{1}{2}$ sq. ft.? in $\frac{1}{4}$ sq. ft.? in $\frac{3}{4}$ sq. ft.?

23. How many square inches are there in 2 sq. ft.? in $\frac{1}{4}$ of 2 sq. ft.? in $\frac{3}{4}$ of 2 sq. ft.?

PROBLEMS WITHOUT NUMBERS

1. If you buy a certain number of pounds of something, how do you find the number of ounces?

2. If you buy a part of a pound, how do you find the number of ounces that you buy?

3. If a grocer knows the number of ounces in the weight of a piece of butter, how can he find the number of pounds without weighing it? Can you do this, or must you learn more? What is it that you must learn?

4. If you know the number of square feet in a rectangle, how do you find the number of square inches?

5. If you know the number of square feet in the area of the floor, how do you find the number of square yards?

6. If you know the length and the width of the floor, how do you draw the plan of the floor to scale?

7. If you know a quarter of any number, how do you find the number?

8. If you know a quarter of any number, how do you find three quarters of the number?

9. How do you find three quarters of any number?

10. How do you find a sixth of any number? How do you find five sixths of the number?

11. How do you find an eighth of any number? Name three other fractions of the number that you can find from this.

12. How do you find a tenth of any number? Name three other fractions that you can find from this.

VII. MINIMUM ESSENTIALS

WRITTEN EXERCISE

1. Write in figures and in words the number of this year.

2. If you have finished Chapter XIV of a book that has thirty chapters, how many more chapters of the book are there to be read?

3. Copy in a column and add the following numbers: 734 + 387 + 42 + 96 + 407 + 8 + 109 + 360 + 27.

4. If you go to the store and buy goods costing \$1.25, \$3.60, \$0.75, \$4.52, and \$1.68, how much must you pay?

5. If you paid \$3.28 for some meat and some groceries, \$1.75 being for the meat, how much did you pay for the groceries?

6. If you buy goods amounting to \$3.28 and give the clerk \$5, how much change should you receive?

7. Multiply \$3.34 by 6; by 9; by 12; by 75.

8. Multiply \$3.85 by 10; by 20; by 100.

Divide the following:

9. 375 by 5. 10. 846 by 6. 11. 7027 by 9.

Find $\frac{1}{2}$ of each of the following:

12. 96. 13. 118. 14. 330. 15. 578. 16. 912.

Find $\frac{1}{4}$ and also $\frac{3}{4}$ of each of the following:

17. 72 in. 18. 96 yd. 19. 144 sq. in. 20. 332 sq. yd.

21. How many square inches are there in 6 sq. ft.?

VIII. LITTLE EXAMINATIONS

I.	1. $89 + 72$.	5. $196 - 37$.	9. XXI = (?).
	2. $77 + 68$.	6. $363 - 89$.	10. \$1.25 + \$2.30.
	3. $198 + 94$.	7. 59×69.	11. $4 \times 6 + 2$.
	4. $377 + 46$.	8. 2×609.	12. $378 \div 9$.
II.	1. $46 + 98$.	5. $272 - 38$.	9. XVIII = (?).
	2. $95 + 86$.	6. $356 + 39$.	10. \$3.36 + \$2.28.
	3. $79 + 28$.	7. 38×98.	11. $7 \times 8 + 6$.
	4. $598 + 75$.	8. 6×275.	12. $595 \div 7$.
III.	1. $67 + 78$.	5. $352 - 29$.	9. XVII = (?).
	2. $48 + 83$.	6. $494 + 28$.	10. \$6.37 + \$1.98.
	3. $85 + 76$.	7. 4×389.	11. $8 \times 9 + 7$.
	4. $76 + 87$.	8. 6×784.	12. $582 \div 6$.
IV.	1. $89 + 69$.	5. $263 - 98$.	9. $15 \times \$5.75$.
	2. $96 + 76$.	6. 67×86.	10. \$7.42 − \$1.78.
	3. $87 + 587$.	7. 8×323.	11. 3 sq.ft. = (?) sq.in.
	4. $58 + 468$.	8. 9×285.	12. 9 sq.yd. = (?) sq.ft.
V.	1. $\frac{1}{2}$ of 730.	5. $938 + 86$.	9. $37 \times \$7.68$.
	2. $\frac{1}{3}$ of 810.	6. $372 - 86$.	10. 8 pt. = (?) qt.
	3. $\frac{2}{3}$ of 174.	7. 8×643.	11. $\frac{3}{4}$ of \$1280.
	4. $\frac{3}{4}$ of 236.	8. 9×379.	12. $528 \div 8$.

These Little Examinations may be used on different days near the close of a term. Teachers should read the note on page 46.

CHAPTER IV

I. READING AND WRITING NUMBERS

READING AND WRITING NUMBERS

Numbers 1 to 13, oral

1. What year is this? What year was last year? What year will next year be?

2. Count by 100's from 100 to 1000.

3. Count by 1000's from 1000 to 10,000.

4. Read the following: 30,000 = thirty thousand.

5. Count by 10,000's from 10,000 to 100,000.

Read the following numbers:

6. 20,000.	**8.** 10,000.	**10.** 100,000.	**12.** 300,000.
7. 40,000.	**9.** 30,000.	**11.** 200,000.	**13.** 400,000.

Write the following numbers in figures:

14. Forty thousand.

15. Eighty thousand.

16. One hundred thousand.

17. Three hundred thousand.

Write the following numbers in words:

18. 90,000.	**21.** 60,000.	**24.** 100,000.
19. 50,000.	**22.** 30,000.	**25.** 200,000.
20. 70,000.	**23.** 80,000.	**26.** 500,000.

READING AND WRITING NUMBERS

Numbers 1 to 17, oral

Read the following numbers:

1. 10,000.	5. 32,000.	9. 18,000.	13. 300,000.
2. 13,000.	6. 36,000.	10. 18,700.	14. 150,000.
3. 15,000.	7. 43,000.	11. 18,790.	15. 165,000.
4. 19,000.	8. 87,000.	12. 18,796.	16. 265,256.

17. What is the smallest whole number of five figures? the largest whole number of five figures?

The teacher should review at the board the meaning of units' place, tens' place, and so on, and should explain the meaning of a whole number, of periods of three figures, and of units' period and thousands' period.

Write the following numbers in figures:

18. Fourteen thousand, eight hundred.

19. Seventy-six thousand, seventeen.

20. Sixty-nine thousand, eighty-nine.

21. Twenty-seven thousand, six hundred eight.

22. Four hundred thirty-four thousand, two hundred forty-three.

Write the following numbers in words:

23. 62,296.	25. 72,428.	27. 99,999.
24. 81,060.	26. 60,006.	28. 205,205.

29. Write the largest whole number of six figures.

30. Write the smallest whole number and also the largest whole number which you have thus far studied.

READING AND WRITING NUMBERS

Numbers 1 to 13, oral

Read the following statements:

1. Mr. Jones paid $1695.50 for his car.
2. Mr. Roberts spent $5285.75 for his house.
3. The city paid $67,850 for the repair of streets.
4. A dealer sells goods worth $86,975.50.

Read the following numbers:

5. $475.89.	8. $7288.86.	11. $31,845.
6. $608.08.	9. $8462.80.	12. $42,976.50.
7. $928.80.	10. $9060.80.	13. $78,363.75.

Write the following numbers in figures:

14. Four hundred sixty-nine dollars.
15. Six hundred dollars and twenty cents.
16. Seven thousand dollars and seventeen cents.
17. Nineteen hundred dollars and eighty cents.
18. Thirteen hundred dollars and sixty-nine cents.
19. Seven thousand seven hundred sixty-eight dollars and ninety-six cents.
20. Seventy-seven thousand, three hundred eighty-nine dollars and ninety-four cents.

Teachers should call attention to the two ways of reading a number like $1975; namely, "Nineteen hundred seventy-five dollars," and "One thousand nine hundred seventy-five dollars," explaining that the former is generally used. Compare Exs. 18 and 19.

Roman Notation. The Roman notation, used chiefly for numbering the chapters of books, employs seven capital letters, as follows:

Letters,	I	V	X	L	C	D	M
Values,	1	5	10	50	100	500	1000

The first nine numbers are written thus:

I II III IV or IIII V VI VII VIII IX

The tens are written thus:

X XX XXX XL L LX LXX LXXX XC

The hundreds are written thus:

C CC CCC CD D DC DCC DCCC DCCCC or CM

The numbers from eleven to nineteen are written thus:

XI XII XIII XIV XV XVI XVII XVIII XIX

The following are examples of other numbers:

XXXIII = 33 XCVII = 97 CCLXVI = 266

XXXVI = 36 LXXIV = 74 CCCLIV = 354

MDCCCCXXIV or MCMXXIV = 1924

ROMAN NUMERALS

Write each of the following in common figures:

1. XIII. 3. XXXI. 5. LXVII. 7. LXXVII.
2. LXIV. 4. LXXI. 6. XCVIII. 8. XXXIV.

Write each of the following in Roman numerals:

9. 41. 11. 72. 13. 37. 15. 275. 17. 1920.
10. 69. 12. 81. 14. 45. 16. 156. 18. 1925.

II. ADDITION

COUNTING EXERCISE

Numbers 1 to 8, oral

1. If you are taking eggs out of a basket two at a time, you would find it easier to count them by 2's than to count them by 1's. Count by 2's from 2 to 50.

2. Count by 2's from 1 to 21, thus: 1, 3, 5, and so on.

3. If you are taking oranges out of a basket by 3's, you may count them by 3's. Count by 3's from 3 to 30.

4. Count by 3's from 1 to 31, thus: 1, 4, 7, and so on.

5. Count by 3's from 2 to 32, thus: 2, 5, 8, and so on.

6. To find the number of wheels needed for several cars, count by 4's from 4 to 40. How many wheels are needed for 8 cars? Count eight 4's. How much is 8×4?

7. Count by 4's from 1 to 21; from 2 to 22; from 3 to 23; from 4 to 24.

8. Count by 5's to 51, beginning at 1; to 52, beginning at 2; to 53, beginning at 3; to 54, beginning at 4.

9. Write the 5's from 1 to 51; from 2 to 52; from 3 to 53; from 4 to 54.

10. Write the 6's from 6 to 60; the 7's from 7 to 70.

11. Write the 8's from 8 to 80; the 9's from 9 to 90.

12. Write the 10's from 10 to 100; from 1 to 51; from 2 to 52; from 4 to 54; from 7 to 57; from 9 to 59.

13. Write the 100's from 100 to 1000.

14. Write the 1000's from 1000 to 10,000.

COUNTING AND ADDING

Numbers 1 to 11, oral

1. How many apples are there in a half dozen? How many in 1 dozen and a half dozen more?

2. Add 7 to each of these numbers:

1	2	3	4	5	6	7	8	9
11	12	13	14	15	16	17	18	19

3. Count by 6's from 1 to 31, thus: 1, 7, 13, and so on.

4. Count by 7's from 2 to 37, thus: 2, 9, 16, and so on.

5. Count by 8's from 3 to 43; 4 to 44; 5 to 45.

Add the following:

6.	7.	8.	9.	10.	11.
35	77	86	86	78	66
9	9	8	80	30	43

12. Write the 6's from 1 to 61; 2 to 62; 3 to 63.

13. Write the 9's from 3 to 93; 4 to 94; 5 to 95.

Copy the following and add:

14.	17.	20.	23.	26.
439	689	895	$7.38	$9.86
866	766	966	4.69	8.08
15.	**18.**	**21.**	**24.**	**27.**
789	892	976	$7.68	$8.68
960	860	868	9.68	9.67
16.	**19.**	**22.**	**25.**	**28.**
457	956	469	$8.64	$7.48
682	820	675	5.67	8.76

COUNTING AND ADDING

Numbers 1 to 11, oral

1. Add 8 to each of these numbers:

1	2	3	4	5	6	7	8	9
21	32	43	64	95	86	67	78	99

2. Count by 8's from 1 to 81, thus: 1, 9, 17, and so on.
3. Count by 8's from 2 to 82, thus: 2, 10, 18, and so on.
4. Count by 9's from 6 to 96, thus: 6, 15, 24, and so on.
5. Count by 9's from 7 to 97; 8 to 98; 9 to 99.

Add the following:

6. 35	7. 66	8. 87	9. 98	10. 580	11. 790
6	7	8	9	80	80

12. Write the 6's from 4 to 64; 5 to 65.
13. Write the 7's from 3 to 73; 4 to 74; 5 to 75.
14. Write the 8's from 6 to 86; 7 to 87; 9 to 97.

Copy the following and add:

15. 578	18. 884	21. 598	24. $5.96	27. $28.49
976	876	879	8.80	3.78
16. 999	19. 684	22. 586	25. $8.58	28. $48.78
777	406	778	9.69	37.89
17. 859	20. 687	23. 769	26. $6.56	29. $57.69
666	509	852	7.44	48.75

PURCHASING GOODS

Numbers 1 to 6, oral

Imagine that you have made purchases of the following amounts, and find the sums:

1.	2.	3.	4.	5.	6.
18¢	35¢	40¢	68¢	68¢	68¢
30	20	30	12	13	18

The dollars and cents are often indicated by ruled lines as already stated on page 104. This should be reviewed orally. The double line is placed at the left of the dollars.

In adding 35¢ and 17¢ it is easier to begin at the left, simply thinking of 45¢ + 7¢, and similarly in other examples.

Imagine that a man has made purchases of the following amounts, and find the sums:

7.		8.		9.		10.		11.	
19	64	26	75	46	80	25	85	28	73
23	74	8	58	9		34	86	10	07
55	61	4	95	24	70	8	46	6	74
37	80	38	67	9	05	2	08	38	80

12.		13.		14.		15.		16.	
43	68	37	85	48	72	72	78	67	92
28	38	43	60	59	65	69	96	89	65
46	82	72	90	36	38	88	58	76	88
96	62	78	65	66	58	46	29	64	84

MAKING PURCHASES

1. Emma buys a doll for 40¢ and a doll's dress for 30¢. How much does she pay for both?

2. Frank buys a book for 75¢ and a toy airplane for $1. How much does he pay for both?

3. Nellie buys a toy table for $1.50 and some toy dishes for 50¢. How much does she pay in all?

4. Fred paid $1.20 for a baseball and 80¢ for a mitt. Find the amount spent.

5. If you buy one book for $1.40 and another for 60¢, how much do you pay for the two books?

6. Tom bought a pair of roller skates for $1.60 and a tennis racket for $2. How much did he pay in all?

7. Emily paid $1.30 for a book and 90¢ for some writing paper. How much did she pay in all?

8. If you pay $1.50 for some groceries and $1.10 for some meat, how much do you pay in all?

9. Make a problem about buying two things costing between $1 and $2 each, and solve it.

Add the following:

10.	11.	12.	13.	14.
$1.20	$2.40	$4.60	$5.30	$6.20
.60	1.10	2.00	.70	.85

The pupils should be encouraged to solve without pencil and paper as many of the problems on this page as they can. Most pupils can solve them all mentally if encouraged to do so and if not hurried unduly. The problems represent the ones commonly needed at the store.

USING WHAT YOU HAVE LEARNED

1. A farmer sold milk on six days as follows: Monday, 328 qt.; Tuesday, 366 qt.; Wednesday, 346 qt.; Thursday, 358 qt.; Friday, 302 qt., and Saturday, 362 qt. How many quarts did he sell in all?

2. When Mr. Simpson went to Atlanta he paid $32.90 for his ticket, $8.75 at the hotel, $32.75 in shopping, and $975 for an automobile. How much did he spend in all?

3. On the first day of a fair 6230 tickets were sold, on the second day 6312 tickets, and on the third day 6424 tickets. How many tickets were sold on the three days?

4. Mr. Putnam kept a record of his expenses last year. He spent $520 for rent, $1268.80 for food and clothing, $136.75 for pleasure, and $98.85 for other expenses, and saved $638. How much did he earn?

5. William wishes to buy a basket ball. He earns $1.35 by doing errands, his father gives him 75¢, he takes $1.40 from his bank, and his brother gives him 50¢ to make up the amount needed. How much did the ball cost?

6. A boy in the city has a news stand. He sold $3.40 worth of papers in one day, $2.75 the next day, and $3.15 the next day. He sold magazines to the amount of $4.80 in the three days. How much did his sales amount to in the three days?

7. Another newsboy in the city sold 72 newspapers on Monday and 28 more than that on Tuesday. How many papers does he sell on Tuesday? on both days?

III. SUBTRACTION

REVIEW DRILL

Numbers 1 to 12, oral

Subtract the following:

1. 13	3. 16	5. 15	7. 53	9. 53	11. 71
8	9	7	10	14	12
2. 43	4. 66	6. 65	8. 53	10. 71	12. 71
8	9	7	13	11	15

There should be plenty of drill of this kind, a little every day or so. In particular it is valuable to drill upon numbers having the same endings, such as $13 - 8$, $23 - 8$, $53 - 8$, and so on. Pupils will find it better to begin at the left in oral subtraction; for example, in the case of $81 - 44$, they should simply think that $41 - 4 = 37$.

13. From the sum of 236 and 348 subtract 297 and check the work.

14. From the sum of \$864 and \$936 subtract \$1012 and check the work.

Subtract, and check the work:

15. 509	18. 700	21. 3478	24. 61,386	27. 70,000
229	429	2984	36,428	39,485
16. 614	19. 700	22. 8000	25. 63,005	28. 70,000
386	552	4408	39,098	42,426
17. 684	20. 950	23. 5280	26. 82,076	29. 80,000
269	685	3689	78,529	52,673

Subtraction of Dollars and Cents. If Mr. Jacobs has \$454.40 and spends \$183.75 of it for some furniture, how much money has he left?

We must take \$183.75 from \$454.40.

This is mostly in the nature of a review. No elaborate explanation is desirable, mechanical efficiency being the chief object. Teachers should consult the note on page 248.

\$454.40
183.75
\$270.65

We see that $10 - 5 = 5$. We write the 5 in cents' place.

Then $13 - 7 = 6$. We write the 6 in dimes' place.

We now write the decimal point.

Then $3 - 3 = 0$. We write the 0 in dollars' place.

Then $15 - 8 = 7$. We write the 7 in tens of dollars' place.

Then $3 - 1 = 2$. We write the 2 in hundreds of dollars' place.

The result is \$270.65; so Mr. Jacobs has \$270.65 left.

PURCHASES OF THE MERCHANT

1. A grocer having \$302.61 on hand paid a farmer \$36.75 for some farm produce. How much money did the grocer have left?

2. A merchant having \$3047.50 on hand paid \$829.86 for some goods. How much did he have left?

3. A dry-goods dealer has \$4208.20 in the bank. Out of it he pays a bill of \$1478.75. How much has he left?

4. A jeweler has \$2083.35 in the bank. Out of it he pays \$1369.75 for some goods. How much has he left?

DRILL WORK

Numbers 1 to 10, oral

Subtract the following:

1. \$4.20	3. \$6.90	5. \$5.68	7. \$6.68	9. \$7.25
.10	1.90	.18	1.68	2.15
2. \$4.08	4. \$8.65	6. \$7.65	8. \$7.75	10. \$8.98
.08	1.60	4.32	.75	1.98

See how many minutes in all it takes you to copy the following, to subtract, and to check the results:

11. \$96.28	17. \$75.36	23. \$86.28	29. \$80.23
74.37	5.88	72.88	20.65
12. \$86.73	18. \$78.40	24. \$35.24	30. \$57.62
37.94	59.52	8.85	9.24
13. \$36.94	19. \$70.00	25. \$41.40	31. \$80.00
18.27	32.86	19.57	6.29
14. \$34.00	20. \$62.09	26. \$61.30	32. \$85.00
.98	26.90	38.75	.78
15. \$82.74	21. \$58.22	27. \$50.00	33. \$82.24
58.82	19.48	25.80	78.86
16. \$27.25	22. \$60.20	28. \$86.04	34. \$92.00
18.64	58.36	46.92	68.26

USING WHAT YOU HAVE LEARNED

1. The four sides of a city park measure 673 ft., 1209 ft., 739 ft., and 1143 ft. When Sarah and Julia walked round the park, how many feet did they walk? This was how much more or how much less than the 5280 ft. in 1 mile?

It will be seen that both addition and subtraction are involved in each example in this exercise. The pupils are now reaching the age when problems of two steps or even three steps are desirable.

2. Two classes had number contests every school day for a week. The score of the first class was 17, 14, 19, 18, and 24, and the score of the second was 16, 15, 18, 20, and 25. What is the difference between the two scores? Which class won the contest?

3. A school concert is to be given in a hall which seats 550 persons. If 64 seats are reserved for visitors and 248 for pupils of the upper grades of the school, how many seats will be left for pupils of the lower grades?

4. Mary goes to the store and pays 48¢ for eggs, 16¢ for spice, and 56¢ for butter. She also pays the dealer $2.18 which her mother owed him. How much change should she receive from a $5 bill?

5. Mr. Brown, who drives an ice wagon, started out one morning with 2600 lb. of ice, and had 85 lb. left after delivering 2375 lb., the rest being lost by cutting and melting. How many pounds of ice were lost?

6. Make up a problem as hard as one of those given above, write it, and then solve it.

The pupils should be encouraged to bring such problems to class.

IV. MULTIPLICATION

Three-Figure Multiplier. Baker and Son are dealers in automobiles in a city. They bought last year 246 automobiles at $564 each. How much did the cars cost them?

We see that the 246 cars cost 246 × $564, so we must multiply $564 by 246.

We multiply by 6, and write the product so that the right-hand figure is in units' place. We then multiply by 4, and write the product so that the right-hand figure is in tens' place. We then multiply by 2, and write the product so that the right-hand figure is in hundreds' place.

$564
246
3384
2256
1128
$138744

Adding the products, we have $138,744, the cost.

MAKING LARGE PURCHASES

1. How much will Baker and Son have to pay for 178 automobiles at $475 each?

2. How much will 116 engines cost at $342 each?

3. A man buys 124 horses at $125 each. How much do they cost him?

4. A factory sells 164 sets of furniture at $148 a set. How much do they cost the purchaser?

5. A city dealer buys 152 rugs at an average price of $138 each. How much do they cost him?

6. A dealer buys 112 sets of furniture at $125 a set. How much do they cost him?

Multipliers with Zeros. 1. If Baker and Son buy 240 cars at $725 each, how much do all the cars cost them?

To multiply by 240 is the same as to multiply by 10×24. We multiply by 10 by annexing 0, and so we may multiply $725 by 24 and annex 0 as here shown.

$$\begin{array}{r} \$725 \\ 240 \\ \hline 29000 \\ 1450 \\ \hline \$174000 \end{array}$$

The product is $174,000, the total cost.

2. A dealer sells 204 farm wagons at $116.67 per wagon. How much money does he receive?

We see that he receives $204 \times \$116.67$.

We multiply as on page 149, except that there is no need to multiply by 0.

We first multiply by 4, and write the product so that the right-hand figure is in cents' place. We then multiply by 2 and, because we are multiplying by hundreds which is the third place from the right, we write the product so that the right-hand figure is in the third place from the right.

$$\begin{array}{r} \$116.67 \\ 204 \\ \hline 466\ 68 \\ 23334 \\ \hline \$23800.68 \end{array}$$

Since we know that the right-hand figure in the product is cents, we place a decimal point in the product between 0 and 6.

The amount received is $23,800.68.

Teachers should be reminded that it is not desirable to demand much in the way of explanation at this time. Talk the solution over with the class and see that it is sufficiently understood; then train for mechanical efficiency. Since numbers as large as these are not often used by children, the mechanical work must predominate on pages 151 and 152.

DRILL WORK

1. At \$125 an acre, how much must a farmer pay for 160 acres of land? for 109 acres? for 240 acres?

2. At \$67.50 a head, how much will 104 head of cattle cost? 152 head? 109 head? 120 head?

Multiply the following:

3.	4.	5.	6.	7.
\$581.20	\$708.75	\$484.38	\$519.46	\$628.58
106	108	207	360	470

8.	9.	10.	11.	12.
\$598.73	\$783.78	\$836.48	\$774.78	\$979.96
581	263	409	280	960

See how many of the following you can copy neatly on paper and solve correctly in 15 minutes:

13. 340×684.	23. 650×609.	33. $322 \times \$147.20$.
14. 298×743.	24. 857×800.	34. $768 \times \$549.75$.
15. 630×847.	25. 500×550.	35. $373 \times \$298.68$.
16. 758×629.	26. 587×750.	36. $507 \times \$268.75$.
17. 834×968.	27. 480×470.	37. $308 \times \$926.82$.
18. 660×666.	28. 608×608.	38. $706 \times \$830.40$.
19. 543×829.	29. 470×687.	39. $640 \times \$307.27$.
20. 280×686.	30. 370×370.	40. $830 \times \$672.83$.
21. 348×843.	31. 800×545.	41. $900 \times \$128.75$.
22. 505×505.	32. 872×950.	42. $346 \times \$784.73$.

REVIEW DRILL

Multiply the following:

1. 47×86.
2. 38×76.
3. 76×99.
4. 74×748.
5. 88×787.
6. 46×958.
7. 76×948.
8. 89×838.
9. 57×668.
10. 70×809.
11. 76×896.
12. 63×807.
13. 234×562.
14. 728×824.
15. 337×609.
16. 407×539.
17. 247×928.
18. 338×694.
19. 425×787.
20. 326×639.
21. 474×779.
22. 320×846.
23. 430×720.
24. $5 \times \$22.78$.
25. $7 \times \$41.78$.
26. $8 \times \$86.53$.
27. $9 \times \$36.42$.
28. $6 \times \$87.87$.
29. $8 \times \$75.79$.
30. $60 \times \$7.70$.
31. $72 \times \$5.46$.
32. $74 \times \$7.92$.
33. $94 \times \$5.74$.
34. $63 \times \$8.48$.
35. $76 \times \$6.98$.
36. $34 \times \$4.98$.
37. $47 \times \$6.81$.
38. $72 \times \$5.97$.
39. $83 \times \$6.85$.
40. $34 \times \$3.54$.
41. $48 \times \$8.64$.
42. $76 \times \$8.56$.
43. $63 \times \$9.94$.
44. $58 \times \$7.40$.
45. $85 \times \$8.80$.
46. $89 \times \$7.56$.
47. $42 \times \$31.44$.
48. $56 \times \$82.87$.
49. $75 \times \$23.98$.
50. $44 \times \$38.47$.
51. $67 \times \$38.06$.
52. $70 \times \$67.92$.
53. $35 \times \$58.38$.
54. $72 \times \$81.96$.
55. $53 \times \$32.78$.
56. $28 \times \$60.08$.
57. $76 \times \$78.83$.
58. $49 \times \$66.66$.
59. $59 \times \$31.07$.
60. $60 \times \$35.70$.
61. $52 \times \$31.96$.
62. $83 \times \$20.70$.
63. $42 \times \$61.96$.
64. $68 \times \$98.98$.
65. $78 \times \$37.46$.
66. $54 \times \$87.96$.
67. $58 \times \$99.99$.
68. $75 \times \$66.68$.
69. $84 \times \$33.49$.

V. DIVISION

PACKING BOXES OF FRUIT

Numbers 1 to 6, oral

1. In packing grapefruits in boxes a Florida packer puts 10 pieces of fruit in a layer and uses 30 pieces. How many layers are there in the box?

2. Divide 40 by 10; 60 by 10; 90 by 10; 120 by 10.

3. State a short way of dividing a number like 160 by 10 by cutting off a certain figure.

4. In packing some smaller grapefruits a packer puts 20 pieces in a layer and uses 80 pieces. How many layers are there?

$$2\emptyset)\overline{8\emptyset}\quad 4$$

5. Divide 40 by 20; 60 by 20; 100 by 20.

6. If a man has 570 pieces of fruit to pack in boxes of 30 each, how many boxes will he need? How much is $57 \div 3$? Then how much is $570 \div 30$?

$$3\emptyset)\overline{57\emptyset}\quad 19$$

Divide each of these numbers by 30:

7. 150	270	300	360	390	420	450
8. 510	540	630	720	750	840	990

Divide the following:

9. $460 \div 20$.	13. $480 \div 60$.	17. $1840 \div 80$.
10. $520 \div 40$.	14. $840 \div 70$.	18. $5400 \div 90$.
11. $350 \div 50$.	15. $1760 \div 80$.	19. $1600 \div 800$.
12. $420 \div 60$.	16. $2430 \div 90$.	20. $8100 \div 900$.

REVIEW DRILL IN DIVISION

Numbers 1 to 54, oral

Divide each of the following numbers by 2, 3, 4, and 5, in turn, giving quotients and remainders, if any:

1. 23.	**6.** 48.	**11.** 60.	**16.** 55.	**21.** 44.	**26.** 43.
2. 35.	**7.** 27.	**12.** 47.	**17.** 46.	**22.** 42.	**27.** 21.
3. 28.	**8.** 51.	**13.** 45.	**18.** 57.	**23.** 56.	**28.** 34.
4. 32.	**9.** 39.	**14.** 22.	**19.** 25.	**24.** 31.	**29.** 38.
5. 30.	**10.** 54.	**15.** 40.	**20.** 59.	**25.** 41.	**30.** 49.

Divide each of the following numbers by 6, 7, 8, and 9, in turn, giving quotients and remainders, if any:

31. 59.	**35.** 20.	**39.** 61.	**43.** 26.	**47.** 48.	**51.** 44.
32. 24.	**36.** 50.	**40.** 21.	**44.** 57.	**48.** 52.	**52.** 47.
33. 18.	**37.** 51.	**41.** 40.	**45.** 22.	**49.** 23.	**53.** 65.
34. 64.	**38.** 29.	**42.** 41.	**46.** 42.	**50.** 32.	**54.** 31.

Divide each of the following numbers by 2, 3, 4, 5, 6, 7, 8, and 9, in turn, giving quotients and remainders:

55. 134.	**59.** 275.	**63.** 327.	**67.** 486.	**71.** 940.
56. 256.	**60.** 341.	**64.** 376.	**68.** 390.	**72.** 604.
57. 572.	**61.** 389.	**65.** 904.	**69.** 852.	**73.** 364.
58. 697.	**62.** 800.	**66.** 301.	**70.** 468.	**74.** 707.

Teachers should clearly understand that drill pages of this kind are to be used only until the pupil has attained sufficient proficiency in the processes. The drill should then be discontinued and new work should be taken up.

Fraction in the Quotient. A sheep raiser weighs four of his sheep and finds that their weights are 170 lb., 191 lb., 160 lb., and 192 lb. He wishes to find their average weight.

The total weight is found by adding. It is 713 lb.

If 4 sheep weigh 713 lb., each sheep weighs, *on the average*, $\frac{1}{4}$ of 713 lb., or 713 lb. $\div$ 4.

Dividing 713 lb. by 4, the quotient is 178 lb. and there is a remainder of 1 lb. still to be divided. But 1 lb. $\div$ 4 $= \frac{1}{4}$ lb. So the *average weight* of the sheep is $178\frac{1}{4}$ lb.

$$\begin{array}{r} 170 \text{ lb.} \\ 191 \\ 160 \\ 192 \\ \hline 4\overline{)713 \text{ lb.}} \\ 178\frac{1}{4} \text{ lb.} \end{array}$$

The case in which the pupil will use a fraction in a quotient at this stage of his progress is in finding an average of some kind. The teacher is therefore advised to take up a number of simple cases.

Reducing fractions to lowest terms need not be considered at present.

FINDING AVERAGES

1. In a certain class the weights of four boys are 50 lb., 56 lb., 58 lb., and 57 lb. Find their average weight.

2. In a certain class the heights of three girls are 48 in., 49 in., and 51 in. Find their average height.

Find the average in each of the following cases:

3. 47 lb., 57 lb., 48 lb.
4. 62 in., 64 in., 62 in.
5. 27 ft., 29 ft., 26 ft.
6. 52 ft., 58 ft., 62 ft.
7. 18 in., 19 in., 16 in., 18 in.
8. 38 yd., 42 yd., 38 yd., 41 yd.
9. 96 lb., 98 lb., 97 lb., 98 lb.
10. 72 ft., 84 ft., 81 ft., 71 ft.

Further Work in Averages. A sheep raiser finds that ten of his sheep together weigh 1813 lb., and he wishes to find their average weight. What is this average weight?

If 10 sheep together weigh 1813 lb., their average weight is 1813 lb. ÷ 10.

We divide 1813 lb. by 10 in the manner here shown.

$$10\overline{)1813}\text{ lb.}$$
$$181\tfrac{3}{10}\text{ lb.}$$

The teacher should explain at the board that we may divide 1810 by 10 by simply cutting off the last figure (0), as has already been shown on page 153. Since 1813 is 3 more than 1810, we have 181 for the whole number in the quotient, with a remainder 3 still to be divided; so the complete quotient is $181\frac{3}{10}$. The abbreviation may be used or not in the computation. In practice, it usually is not written.

FRACTION IN THE QUOTIENT

1. If 10 girls weigh 487 lb., find their average weight.
2. If 10 boys weigh 551 lb., find their average weight.

Divide the following, writing a fraction in the quotient whenever there is a remainder:

3. 73 ÷ 10.	11. 7393 ÷ 4.	19. 8205 ÷ 5.
4. 841 ÷ 10.	12. 3125 ÷ 2.	20. 3264 ÷ 8.
5. 6893 ÷ 10.	13. 4395 ÷ 6.	21. 7725 ÷ 6.
6. 4787 ÷ 10.	14. 7281 ÷ 5.	22. 8195 ÷ 9.
7. 8899 ÷ 10.	15. 6196 ÷ 7.	23. 9464 ÷ 9.
8. 12,471 ÷ 10.	16. 8237 ÷ 8.	24. 6072 ÷ 3.
9. 36,073 ÷ 10.	17. 2496 ÷ 9.	25. 3352 ÷ 7.
10. 40,007 ÷ 10.	18. 9843 ÷ 6.	26. 9682 ÷ 7.

PREPARING FOR LONG DIVISION

All work oral

1. How much is 9×10? $90 \div 9$? $90 \div 10$?
2. How much is 9×11? $99 \div 9$? $99 \div 11$?
3. How much is 10×11? $110 \div 10$? $110 \div 11$?

State the following products and quotients:

4. 4×11	$44 \div 4$	$44 \div 11$	$22 \div 11$
5. 7×11	$77 \div 7$	$77 \div 11$	$66 \div 11$

6. If there are 88 pears in 11 boxes, what is the average number of pears in each box?

Divide each of the following numbers by 11:

7. 55. 8. 550. 9. 5500. 10. 6600.

11. If we divide 35 by 11, what is the whole number in the quotient and what is the remainder?

Divide each of the following numbers by 11, stating the quotient and also the remainder, if any:

12. 33.	16. 34.	20. 48.	24. 70.	28. 40.	32. 990.
13. 44.	17. 45.	21. 68.	25. 39.	29. 53.	33. 991.
14. 66.	18. 67.	22. 38.	26. 50.	30. 75.	34. 997.
15. 99.	19. 36.	23. 49.	27. 72.	31. 82.	35. 999.

36. At \$12 each, how many desks can you buy for \$25, and how much money will be left?

37. At \$11 each, how many desks can you buy for \$35, and how much money will be left?

38. If a dealer in school desks has to pay \$6 for a pupil's desk, how do you find how many desks he can buy for \$200 and how much money he will have left?

The pupil is not expected to perform the operation mentally. The purpose of this oral question and of those immediately following is to lead him to see the importance of extending his knowledge to long division.

39. If a dealer has to pay \$11 for a teacher's desk, and has \$200 with which to buy a number of such desks, how do you find how many desks he can buy for \$200 and how much money he will have left? Can you do this work yet? Could you do it if the price of each desk was \$10 instead of \$11?

Divide by 11 such of the following numbers as you can easily divide without pencil and paper, stating the remainder if there is one, and divide the others on paper after you have studied the next page:

40. 11.	**51.** 330.	**62.** 3300.	**73.** 3333.
41. 56.	**52.** 660.	**63.** 6601.	**74.** 6677.
42. 24.	**53.** 220.	**64.** 5501.	**75.** 5507.
43. 88.	**54.** 880.	**65.** 8800.	**76.** 8831.
44. 78.	**55.** 770.	**66.** 7766.	**77.** 7744.
45. 69.	**56.** 551.	**67.** 2233.	**78.** 3322.
46. 12.	**57.** 440.	**68.** 3304.	**79.** 3343.
47. 56.	**58.** 552.	**69.** 5505.	**80.** 5610.
48. 78.	**59.** 671.	**70.** 6607.	**81.** 6610.
49. 89.	**60.** 883.	**71.** 8808.	**82.** 8911.
50. 91.	**61.** 994.	**72.** 9999.	**83.** 7921.

Long Division. If a dealer pays \$176 for 11 Boy Scout suits, how much does he pay for each suit?

For each suit he must pay \$176 ÷ 11, so we need to know how to divide \$176 by 11. In such division we need not write the dollar sign (\$).

The following shows the work which we do:

Divide,	$17 \div 11$
Multiply,	1×11
Subtract; then	$66 \div 11$
Multiply,	6×11
Subtract; no remainder.	

Written Work	Check
16	16
11)176	11
11	176
66	
66	

The teacher should put this work on the blackboard, explain what is done in each step, show the pupil what he is expected to write (Written Work), and explain the check. Although short division should be used in dividing by 11, this is the best divisor for the purpose of introducing long division. Tell the class the difference between short division and long division.

DIVIDING BY 11

Divide each of the following numbers by 11:

1. 132.	**3.** 1232.	**5.** 1342.	**7.** 4752.	**9.** 3641.
2. 143.	**4.** 1243.	**6.** 1452.	**8.** 3542.	**10.** 7898.

11. At \$11 each, how many football suits can a dealer buy for \$726? for \$737? for \$847?

12. At \$11 each, how many Boy Scout suits can a dealer buy for \$253? for \$363? for \$374?

13. If 11 girls weigh 649 lb., find their average weight.

Two-Figure Divisor. A piano manufacturer sold 21 pianos for $8925. How much did he receive for each piano?

We see that we must divide $8925 by 21.

Before we divide, it is a good plan, at first, to write out a table of 21's, as follows:

$1 \times 21 = 21$	$4 \times 21 = 84$	$7 \times 21 = 147$
$2 \times 21 = 42$	$5 \times 21 = 105$	$8 \times 21 = 168$
$3 \times 21 = 63$	$6 \times 21 = 126$	$9 \times 21 = 189$

Such tables should not be used after the work is understood.

We see that we have first to divide 89 hundreds by 21. Since we do not find the product 89 in the table, we look for the largest product smaller than 89 and find that product to be 84. We see that $4 \times 21 = 84$, or 5 less than 89. So we know that 89 hundreds $\div$ 21 = 4 hundreds, with remainder 5 hundreds. We write the 4 in the quotient in hundreds' place.

```
   425
21)8925
   84
   52
   42
   105
   105
```

The remainder, 5 hundreds, is equal to 50 tens, and 50 tens + 2 tens = 52 tens.

From the table we see that $2 \times 21 = 42$, which is 10 less than 52. So we know that 52 tens $\div$ 21 = 2 tens, with remainder 10 tens, or 100. We write the 2 in the quotient in tens' place.

Then 100 + 5 = 105, still to be divided. From the table we see that $5 \times 21 = 105$, so we know that $105 \div 21 = 5$. We write the 5 in the quotient, in units' place.

The quotient is then 425, and so the manufacturer received $425 for each piano.

DIVISORS ENDING IN 1

Numbers 1 to 11, oral

1. Divide each of the following numbers by 31 and state the quotient; if you cannot tell the quotient readily, use the first two figures of the dividend and the first figure of the divisor:

124 155 186 217 248 279

2. Using the first two figures of the dividend and the first figure of the divisor as in Ex. 1, divide each of the following numbers by 41 and state the quotient:

123 164 205 246 287 328

State only the first figure in each quotient:

3. $231 \div 21$.
4. $441 \div 21$.
5. $399 \div 21$.
6. $620 \div 31$.
7. $682 \div 31$.
8. $961 \div 31$.
9. $1530 \div 51$.
10. $1281 \div 61$.
11. $2201 \div 71$.

Divide the following:

12. $441 \div 21$.
13. $693 \div 21$.
14. $525 \div 21$.
15. $2457 \div 21$.
16. $4893 \div 21$.
17. $465 \div 31$.
18. $984 \div 41$.
19. $589 \div 31$.
20. $1178 \div 31$.
21. $5661 \div 51$.
22. $3045 \div 21$.
23. $3486 \div 21$.
24. $4179 \div 21$.
25. $2652 \div 51$.
26. $8591 \div 71$.

27. At \$31 a dozen, how many dozen rifles can a dealer buy for \$713? for \$837? for \$961?

28. At \$41 a dozen, how many dozen boys' sweaters can a dealer buy for \$615? for \$943? for \$1312?

Long Division Continued. In a certain peach orchard it is known that 3328 trees have been planted in rows, 32 trees in each row. How many rows are there?

If we were at the orchard we could count the rows, but even then it would be easier to find the answer by arithmetic. If there are 32 trees in each row, there are just as many rows of trees as there are 32's in 3328.

We have 33 hundreds ÷ 32 = 1 hundred, with remainder 1 hundred.

We write the 1 in hundreds' place in the quotient.

Bringing down the next figure, 2 (tens), we have 12 tens to be divided by 32.

But 12 does not contain 32, so we write 0 in tens' place in the quotient.

Bringing down the next figure, 8, we have 128 to be divided by 32.

128 ÷ 32 = 4, and we write the 4 in units' place.

The quotient is 104, and so there are 104 rows of trees.

```
   104
32)3328
   32
   128
   128
```

USING WHAT YOU HAVE LEARNED

1. A dealer receives $4536 for a number of canoes, each canoe selling at $42. How many canoes does he sell?

2. A dealer pays $6592 for a number of bicycles, each bicycle costing $32. How many bicycles does he buy?

3. A dealer buys a lot of young Shetland ponies and pays $82 apiece for them. He pays $8856 for the lot. How many ponies does he buy?

Long Division Continued. To divide 4503 by 79 we write the numbers as here shown.

$$\begin{array}{r} 57 \\ 79\overline{)4503} \\ \underline{395} \\ 553 \\ \underline{553} \end{array}$$

At first we might think that, because $45 \div 7 = 6$ and a remainder, the first figure of the quotient should be 6. But this would be too large, as we should find, because $6 \times 79 = 474$, and 474 is larger than 450.

We see that 79 is nearly 80, and so we see that we can find the first figure of the quotient more easily by thinking of $45 \div 8$ than by thinking of $45 \div 7$.

In division no product should be larger than the number shown by the figures just above it, and no remainder after any subtraction should be larger than the divisor.

Dividing in the usual way, we find that the quotient obtained by dividing 4503 by 79 is 57.

Check in Division. To divide 5183 by 58 we write the numbers as here shown.

$$\begin{array}{r} 89 \\ 58\overline{)5183} \\ \underline{464} \\ 543 \\ \underline{522} \\ 21 \end{array}$$

Dividing in the usual way, we find that the quotient is 89 and that there is a remainder of 21.

We have learned that it is customary in such a case to write the result $89\frac{21}{58}$.

To check the work in division

We multiply the divisor by the quotient and to this product add the remainder. This sum should be equal to the dividend.

In this case $58 \times 89 = 5162$, and $5162 + 21 = 5183$.

DRILL WORK IN DIVISION

Divide the following, timing yourself:

1. $168 \div 21$.
2. $728 \div 91$.
3. $256 \div 32$.
4. $581 \div 83$.
5. $295 \div 59$.
6. $369 \div 41$.
7. $781 \div 71$.
8. $468 \div 52$.
9. $511 \div 73$.
10. $632 \div 79$.
11. $729 \div 81$.
12. $488 \div 61$.
13. $576 \div 72$.
14. $930 \div 93$.
15. $891 \div 99$.

Divide, writing "remainder" after each remainder:

16. $3806 \div 41$.
17. $5663 \div 61$.
18. $4794 \div 82$.
19. $8497 \div 73$.
20. $7719 \div 94$.
21. $6434 \div 59$.
22. $2464 \div 22$.
23. $6385 \div 77$.
24. $3366 \div 51$.
25. $8268 \div 81$.
26. $9788 \div 92$.
27. $6498 \div 53$.

Divide, using fractions instead of remainders:

28. $6893 \div 84$.
29. $7410 \div 65$.
30. $5368 \div 22$.
31. $9639 \div 44$.
32. $6461 \div 71$.
33. $6647 \div 91$.
34. $5084 \div 62$.
35. $9504 \div 72$.
36. $3569 \div 29$.
37. $8148 \div 74$.
38. $3432 \div 66$.
39. $3960 \div 55$.
40. $4872 \div 56$.
41. $2697 \div 93$.
42. $3648 \div 32$.
43. $8512 \div 76$.
44. $8556 \div 23$.
45. $5110 \div 14$.
46. $5248 \div 64$.
47. $3441 \div 37$.
48. $8579 \div 73$.
49. $9036 \div 79$.
50. $7372 \div 53$.
51. $8609 \div 61$.
52. $6891 \div 31$.
53. $3954 \div 23$.
54. $3655 \div 43$.
55. $2576 \div 92$.
56. $9853 \div 49$.
57. $7369 \div 52$.
58. $9423 \div 63$.
59. $6578 \div 74$.
60. $6516 \div 59$.

USING WHAT YOU HAVE LEARNED

1. A farmer raises 504 bu. of wheat on 8 acres. What is the average yield per acre?

Such new expressions as "per acre," gradually introduced as the pupil progresses, should be explained orally when necessary. The exact size of the acre is not at present of importance.

2. If the total weight of 31 pupils in your class is 1767 lb., what is the average weight?

3. If a farmer pays $2752 for 43 head of cattle, how much does he pay a head?

4. An agent sells 23 sewing machines for $713. How much does he receive for each?

5. The school attendance for 24 days in our room was 576. What was the daily attendance?

6. A city dealer bought 25 children's bicycles for $425. How much did they cost apiece?

7. At $91 each, how many Texas ponies can be bought for $3367? How many can be bought for $3549?

8. An express train made a run of 504 miles in 12 hr. What was the rate per hour?

9. How many street cars, each carrying 66 persons, will it take to carry 1122 persons?

10. If an automobile goes at the rate of 18 miles an hour, how many hours will it take to go 1134 miles?

11. A man has $1330 with which to purchase cows. At $65 apiece, how many cows can he buy, and how much money will he have left?

Dividing Dollars and Cents. 1. A man paid \$5 for four hats for his boys. How much did he pay for each hat?

Each hat cost $\frac{1}{4}$ of \$5, or \$5 ÷ 4, so we must know how to divide \$5 by 4.

We write \$5.00 for \$5 and divide just as we do with other numbers, placing the decimal point in the quotient exactly below the decimal point in the dividend.

$$4)\$5.00$$
$$\$1.25$$

The quotient is \$1.25; so he paid \$1.25 for each hat.

2. A dealer paid \$42.24 for 32 bu. of apples. How much did he pay for each bushel?

He paid \$42.24 ÷ 32 for each bushel.

We divide just as we do with other numbers, placing the decimal point in the quotient exactly above the decimal point in the dividend. The quotient is \$1.32; so he paid \$1.32 for each bushel.

We check our work by multiplying \$1.32 by 32, the result being \$42.24.

$$\begin{array}{r} \$1.32 \\ 32\overline{)\$42.24} \\ 32 \\ \hline 102 \\ 96 \\ \hline 64 \\ 64 \\ \hline \end{array}$$

DIVIDING DOLLARS AND CENTS

Divide the following and check each result:

1. \$91 ÷ 4.
2. \$3.80 ÷ 5.
3. \$22.82 ÷ 7.
4. \$34.92 ÷ 9.
5. \$17.52 ÷ 12.
6. \$20.55 ÷ 15.
7. \$19.18 ÷ 14.
8. \$35.91 ÷ 27.
9. \$13.02 ÷ 21.
10. \$38.40 ÷ 32.
11. \$15.68 ÷ 56.
12. \$25.92 ÷ 54.
13. \$38.44 ÷ 62.
14. \$23.25 ÷ 75.
15. \$46.50 ÷ 75.

USING WHAT YOU HAVE LEARNED

1. A full game of baseball of 9 innings was played in 144 min. Find the average time of an inning.

2. In a school having 1144 pupils there are 26 classes. Find the average number in a class.

3. A farmer raised 9000 bu. of corn on 72 acres. How many bushels did an acre average?

4. A grocer has 588 eggs. He puts them into boxes each holding 1 doz. eggs. How many boxes does he use?

5. A clerk has to wrap up 1-cent pieces in packages of 25. If he has \$13.75, how many cents has he, and how many packages will he wrap?

6. A laborer earned \$119 in 28 days. How much did he earn per day?

7. A family spends \$702.52 for groceries in 52 weeks. Find the average amount per week.

8. An electric-light bill was \$10.08 for 63 days. How much did it average per day?

9. At a church fair \$48.30 was taken in the first day, \$51.60 the second day, and \$89.40 the third day. Find the average amount per day.

10. A class of 28 pupils used 63 pads of paper last term, each pad containing 80 sheets. Find the average number of sheets per pupil.

11. If the class in Ex. 10 uses only 56 pads of paper this term, each pad containing 80 sheets, what is the average number of sheets per pupil?

REVIEW DRILL

1. If the dividend is \$48.25 and the divisor is 25, what is the quotient?

2. If the quotient is 427 and the divisor is 34, what is the dividend?

3. If the quotient is 12 and the dividend is 288, what is the divisor?

4. If the divisor is 7, the whole number in the quotient 14, and the remainder 4, what is the dividend?

5. Without dividing, find whether $2104 \div 62 = 34$. You may use multiplication if you wish.

6. Divide \$83.05 by 55 and check the work.

7. Divide 81,180 by 42 and check the work.

Divide, giving the quotient, and the remainder if any:

8. $924 \div 28$.	**14.** $4450 \div 25$.	**20.** \$88.55 ÷ 55.
9. $462 \div 66$.	**15.** $4450 \div 24$.	**21.** \$46.80 ÷ 39.
10. $462 \div 14$.	**16.** $5292 \div 49$.	**22.** 32,297 ÷ 72.
11. $272 \div 34$.	**17.** $3185 \div 98$.	**23.** 41,072 ÷ 67.
12. $550 \div 22$.	**18.** $6954 \div 57$.	**24.** 77,760 ÷ 32.
13. $651 \div 21$.	**19.** $7872 \div 41$.	**25.** 164,976 ÷ 84.

Divide the following:

26. 38,241 ÷ 63.	**30.** 78,507 ÷ 99.	**34.** 69,450 ÷ 75.
27. 30,456 ÷ 47.	**31.** 84,916 ÷ 52.	**35.** 89,664 ÷ 96.
28. 26,978 ÷ 82.	**32.** 54,516 ÷ 84.	**36.** 38,025 ÷ 75.
29. 96,657 ÷ 87.	**33.** 92,456 ÷ 28.	**37.** 10,989 ÷ 99.

VI. MEASURES AND FRACTIONS

MEASURING LENGTH

All work oral

1. What measures are these children using? How many inches are there in each?

2. The foot is what part of the yard? The inch is what part of the foot?

3. If the blackboard is $5\frac{1}{2}$ ft. long, it is 5 ft. and how many inches long?

4. If the blackboard is 1 yd. high, it is how many feet high? how many inches high?

5. Recite the table of length, including inches, feet, and yards.

Measuring Liquids. You have learned about the pint, quart, and gallon (page 86), but another measure, the *gill*, is sometimes used. Read and learn this table:

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

Sometimes, in the home, in the grocery, or on the farm, we wish to find the number of pints in a certain number of quarts, or to make some other change of this kind.

1. Suppose that we wish to express 5 qt. as pints. We say that

$$1 \text{ qt.} = 2 \text{ pt.},$$

and so

$$5 \text{ qt.} = 5 \times 2 \text{ pt.}$$
$$= 10 \text{ pt.}$$

2. Suppose that a grocer has 48 qt. of sirup, and he wishes to know how many gallons he has. We say that

$$1 \text{ qt.} = \tfrac{1}{4} \text{ gal.},$$

and so

$$48 \text{ qt.} = 48 \times \tfrac{1}{4} \text{ gal.}$$

Now $48 \times \frac{1}{4}$ gal. is the same as $\frac{1}{4}$ of 48 gal., and so we know that the number of gallons is $48 \div 4$, or 12.

So

$$48 \text{ qt.} = \tfrac{1}{4} \times 48 \text{ gal.}$$
$$= 12 \text{ gal.}$$

Pupils at this stage of their work are not expected to explain such reductions very elaborately. The above forms are accurate, but a pupil might properly think, for example, that there are 4 qt. in 1 gal., and in 48 qt. there are *as many gallons* as $48 \div 4$, or 12 gal.

USING WHAT YOU HAVE LEARNED

Numbers 1 to 4, oral

1. Mrs. Kane has a recipe for cooking which tells her to use 1 gi. of vinegar. What part of a pint does she use?

2. If Mrs. Kane has $\frac{1}{2}$ pt. of vinegar in the pantry, how many gills of vinegar has she?

3. The milkman starts out with 10 gal. of milk and 1 gal. of cream. How many quarts of each does he have?

4. If Mrs. Kane buys $1\frac{1}{2}$ qt. of milk, how many pints does she buy?

5. If Ruth's mother buys 2 qt. of milk to-day and pays 12¢ a quart, how much does she pay for the milk? How much is she paying for each pint of milk that she buys? How much would a gallon of milk cost?

6. If Mr. Putnam, the grocer, buys 80 gal. of vinegar and puts it up in quart bottles for sale, how many quart bottles can he fill? How many pint bottles could he fill?

7. If the milkman charges 40¢ a pint for cream, how much does he charge a quart? If he has a gallon of cream and sells it all, how much does he get for it?

8. A milk dealer has 75 qt. of milk. How many pint bottles can he fill with this amount?

Oral and written work of this kind should be given to show the relations of the parts of each table, one to another. This textbook furnishes plenty of such abstract work, but the teacher may profitably supplement it by home problems made by the class and representing prices in the community. There should also be given simple exercises in estimating the capacity of glasses, pitchers, and the like, in the schoolroom.

MEASURING TIME

Numbers 1 to 9, oral

1. How old are you? In what year were you born?

2. When is your birthday? How old will you be on your next birthday?

3. What day of the week and of the month is to-day?

4. Do you know how many days there are in this month? in last month? in next month?

5. Do you know how many days there are in a year? Some years are leap years. Do you know how many days there are in a leap year?

6. Name the days in the week. How many days are there in each week?

7. Can you name the months in the year?

It is not probable that all the pupils in the class can answer every one of the above questions. The questions are simply suggestive of the oral work that should precede the study of the table of time.

8. If there are 7 days in a week, how many days are there in 3 weeks?

9. If you have a vacation of 8 weeks in the summer, how many days are there in the vacation?

10. There are 60 minutes in an hour. How many minutes are there in the 12 hours from noon to midnight?

11. How many minutes are there in the 24 hours of the day, including the night?

12. How many minutes are there in half an hour? in $1\frac{1}{2}$ hours? in $2\frac{1}{2}$ hours?

Time Measure. The table of time is as follows:

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
About 4 weeks = 1 month (mo.)
12 months = 1 year (yr.)
100 years = 1 century

The days of the week are Sunday, Monday. Tuesday, Wednesday, Thursday, Friday, Saturday.

The months of the year and the number of days in each month are as follows:

January, 31 da.	July, 31 da.
February, 28 da. or 29 da.	August, 31 da.
March, 31 da.	September, 30 da.
April, 30 da.	October, 31 da.
May, 31 da.	November, 30 da.
June, 30 da.	December, 31 da.

Thirty days has September,
April, June, and November.

February has 28 da. except in a leap year, when it has 29 da. Until the year 2100 every fourth year is a leap year; that is, 1920, 1924, 1928, and so on, are leap years. Common years have 365 da.; leap years have 366 da. There are 52 wk. and 1 da. in a common year.

Every morning the teacher should have one of the pupils write on the blackboard the day of the week and the day of the month.

USING WHAT YOU HAVE LEARNED

1. If there are 5 school days in each week, how many school days are there in a school year of 37 wk.? in one of 38 wk.? in one of 39 wk.?

2. If you are in school 6 hr. each day, how many hours are you in school in the 5 da. of the school week?

3. If you are in school 6 hr. each school day, 5 da. in the week, for 39 wk., how many hours are you in school each year, not counting holidays or absences?

4. If Kate leaves home at 8 A.M., takes lunch at school, and reaches home at 4 30 P.M., how long has she been away from home?

5. How many more days are there this year in January than in February? How many more days in March than in February? in April than in February?

6. Tom was riding on a train one day. He held his watch in his hand and found that it took the train 70 sec. to go from one milepost to the next. At this rate, how many seconds would it take the train to go 6 miles? How many minutes is this?

7. Suppose that a train goes 1 mile in 80 sec., how many seconds will it take the train to go 6 miles? How many minutes is this?

8. Suppose that a train leaves a certain station at 11 30 A.M. and arrives at another station at 1 30 P.M., how long has it taken to make the trip?

9. How many minutes from 9 45 A.M. to 10 15 A.M.?

FRACTIONS NEEDED IN SEWING

1. Sue needs $\frac{1}{2}$ yd. of cloth for a doll's dress. She has a yard of cloth. How many dresses can she make from it?

2. Sue has 2 yd. of another kind of cloth. How many dresses, of the kind stated in Ex. 1, can she make from it?

3. If Sue uses $\frac{1}{3}$ of a piece of cloth that is $1\frac{1}{2}$ yd. long, what part of a yard does she use? Draw a line on the blackboard to represent $1\frac{1}{2}$ yd., and mark off $\frac{1}{3}$ of it.

Teachers should recognize that the object of such a problem, as of this entire page, is to show the necessity for further work in fractions. It is not so important that the question should be answered promptly, or even answered at all without some help, as to have the pupil feel that he must learn more about fractions. The problems furnish a motive for progress.

4. Sue's mother gives her a piece of cloth 20 in. long and tells her she can have half of it. Sue says that even 20 in. is not enough, but that she needs $1\frac{1}{2}$ times as much. Can you tell how much she needs?

5. Sue's mother tells her that she has a piece of cloth 1 yd. long and can spare her all but 6 in. How much can Sue have? From Ex. 4, is this as much as she needs?

6. For trimming some dolls' clothes Sue has a piece of ribbon $4\frac{1}{4}$ in. long, and another piece of the same kind $3\frac{1}{4}$ in. long. Allowing a loss of $\frac{1}{4}$ in. for sewing the pieces together, how long a piece will these make?

7. Sue has a piece of lace 19 in. long. If she uses $\frac{1}{4}$ of it, how many inches of lace will she have left?

8. If Sue has two pieces of braid, each $7\frac{3}{4}$ in. long, how many inches of braid has she in all?

MEASURING OBJECTS

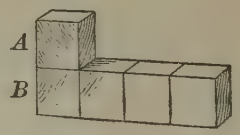
All work oral

1. If this block is 8 in. high and $\frac{1}{2}$ as thick, how many inches thick is it?

2. If the block weighs 6 lb., how many pounds would it weigh if it were only $\frac{1}{3}$ as high?

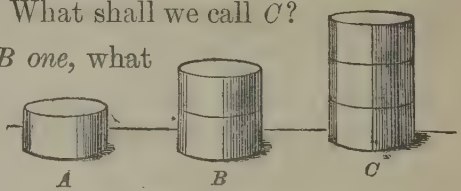
3. If the block weighs 6 lb., how many pounds would it weigh if it were exactly twice as high?

4. The ends of each of these blocks are 1 in. square; *A* is 1 in. long and *B* is 4 in. long. If we call *A* *one*, what shall we call *B*? If we call *B* *one*, what shall we call *A*? If we call *A* *two*, what shall we call *B*?



5. If we call the round block *A* *one*, what shall we call the round block *B*? What shall we call *C*?

6. If we call block *B* *one*, what shall we call block *A*? What shall we call *C*?



7. If we call block *B* *two*, what shall we call *A*? What shall we call *C*?

8. If we call block *C* *one*, what shall we call *B*? What shall we call *A*?

9. If block *B* weighs 4 lb., how much does *A* weigh?

10. If block *C* weighs 9 lb., how much does *A* weigh? How much does *C* weigh?

This is typical of the work with objects that should be taken up from time to time in order to keep the idea of a fraction clearly before the pupils.

BUILDING PARTS OF NUMBERS

All work oral

4	5	6	7
4 4	5 5	6 6	7 7
4 4 4	5 5 5	6 6 6	7 7 7
4 4 4 4	5 5 5 5	6 6 6 6	7 7 7 7
4	5	6	7
8	10	12	14
12	15	18	21
16	20	24	28

1. Point to the column of which the sum is 16. How many 4's has that column? Point to the column that has half as many 4's. What is its sum? This shows that 8 is what part of 16?

2. Point to $\frac{1}{4}$ of 16; to $\frac{3}{4}$ of 16. How much is $\frac{3}{4}$ of 16?

Point to the columns representing the following numbers, and tell the answer in each case:

3. 10, $\frac{1}{2}$ of 10, and $\frac{3}{2}$ of 10, or $1\frac{1}{2} \times 10$.

4. 15, $\frac{1}{3}$ of 15, $\frac{2}{3}$ of 15, and $1\frac{1}{3} \times 15$.

5. 14, $\frac{1}{2}$ of 14, $\frac{3}{2}$ of 14, and $\frac{4}{2}$ of 14, or 2×14.

6. 21, $\frac{1}{3}$ of 21, $\frac{2}{3}$ of 21, and $\frac{4}{3}$ of 21, or $1\frac{1}{3} \times 21$.

7. 28, $\frac{1}{4}$ of 28, $\frac{2}{4}$ of 28, or $\frac{1}{2}$ of 28, and $\frac{3}{4}$ of 28.

8. 12, $\frac{1}{3}$ of 12, $\frac{2}{3}$ of 12, $\frac{1}{2}$ of 12, and $1\frac{1}{2} \times 12$.

9. Think of $\frac{1}{3}$ of each of the following numbers, and then state $\frac{2}{3}$ of each: 9, 6, 12, 3, 21, 30, 36.

Teachers will observe that the finding of fractional parts of numbers, that is, the multiplication by simple fractions, is the operation that naturally comes first in dealing with fractions.

USING FRACTIONS AT THE STORE

Numbers 1 to 14, oral

1. Ruth bought $\frac{1}{2}$ yd. of cloth at 40¢ a yard. How much did she pay for the cloth?

2. Ruth bought $\frac{1}{4}$ yd. of lace at 48 ¢ a yard. How much did that cost? How much would $\frac{3}{4}$ yd. cost?

3. Tom went to the market and bought $\frac{1}{4}$ lb. of cheese at 44¢ a pound. How much did he pay for it? How much would he pay for $\frac{3}{4}$ lb.?

4. Sarah asked for $\frac{1}{4}$ yd. of trimming. How many inches should she receive? If she had bought $\frac{3}{4}$ yd., how many inches should she have received?

State the number in each of the following:

5. $\frac{1}{6}$ doz. **6.** $\frac{5}{6}$ doz. **7.** $\frac{1}{3}$ doz. **8.** $\frac{2}{3}$ doz. **9.** $\frac{5}{12}$ doz.

State the number of inches in each of the following:

10. $\frac{1}{6}$ yd. **11.** $\frac{5}{6}$ yd. **12.** $\frac{1}{9}$ yd. **13.** $\frac{2}{9}$ yd. **14.** $\frac{5}{9}$ yd.

15. A grocer has for sale some boxes of oranges, each box containing 160 oranges. Some Boy Scouts bought half a box. How many oranges did they buy?

16. If the boys in Ex. 15 bought $\frac{1}{2}$ of a box of 184 oranges, how many oranges did they buy?

17. A farmer took 96 eggs to a store, and the dealer bought $\frac{2}{3}$ of them. How many eggs did he buy?

18. Mr. Kane is a dealer in hats. He bought $\frac{3}{4}$ doz. of one kind of hat at $36 a dozen. How much did the hats cost him?

REVIEW DRILL

Numbers 1 to 9, oral

1. How do you find $\frac{1}{2}$ of a number?

2. To find $\frac{3}{4}$ of a number you first divide by what number? You then multiply by what number?

3. Find $\frac{3}{4}$ of 8; of 12; of 16; of 20; of 40; of 48.

4. How do you find $\frac{2}{3}$ of a number?

5. Find $\frac{2}{3}$ of 9; of 12; of 15; of 21; of 33; of 36.

6. How do you find $\frac{4}{5}$ of a number?

7. Find $\frac{4}{5}$ of 10; of 15; of 25; of 35; of 500.

8. How do you find $\frac{5}{6}$ of a number?

9. Find $\frac{5}{6}$ of 12; of 18; of 24; of 36; of 300.

Find $\frac{1}{3}$, and then $\frac{2}{3}$, of each of the following:

10. 18. 11. 24. 12. 39. 13. 42. 14. 450.

Find $\frac{1}{5}$, and then $\frac{2}{5}$, $\frac{3}{5}$, and $\frac{4}{5}$, of each of the following:

15. 30. 16. 45. 17. 50. 18. 55. 19. 600.

Find $\frac{3}{4}$ of each of the following:

20. 96. 21. 120. 22. 164. 23. 180. 24. 360.

Find $\frac{3}{8}$ of each of the following:

25. 176. 26. 264. 27. 352. 28. 576. 29. 656.

Find $\frac{5}{8}$ of each of the following:

30. 184. 31. 272. 32. 368. 33. 592. 34. 744.

Find $\frac{7}{8}$ of each of the following:

35. 496. 36. 504. 37. 568. 38. 848. 39. 968.

USING WHAT YOU HAVE LEARNED

1. Joe has 75 marbles and Tom has $\frac{3}{5}$ as many. How many marbles has Tom?

2. If 45 drops of water make a teaspoonful, how many drops of water make $\frac{3}{5}$ of a teaspoonful?

3. In a certain school there are 396 pupils and half of them are girls. How many girls are there?

4. A man had \$4500 in the bank and later took out $\frac{1}{3}$ of it. How much did he take out?

5. In a certain school there are 584 pupils and $\frac{3}{4}$ of them are in the first five grades. How many are there in the first five grades?

6. If you spend $\frac{1}{3}$ of your time in sleep, how many hours do you sleep in a week?

7. If you are in school $\frac{1}{4}$ of the time on Monday, how many hours are you in school on that day, and how many hours are you not in school?

8. If Mr. Johnson weighs 168 lb. and his son $\frac{1}{4}$ as much, how much does the son weigh? How much do the father and son together weigh?

9. Ethel uses 8 cupfuls in measuring out 4 lb. of flour. How many ounces of flour does the cup hold?

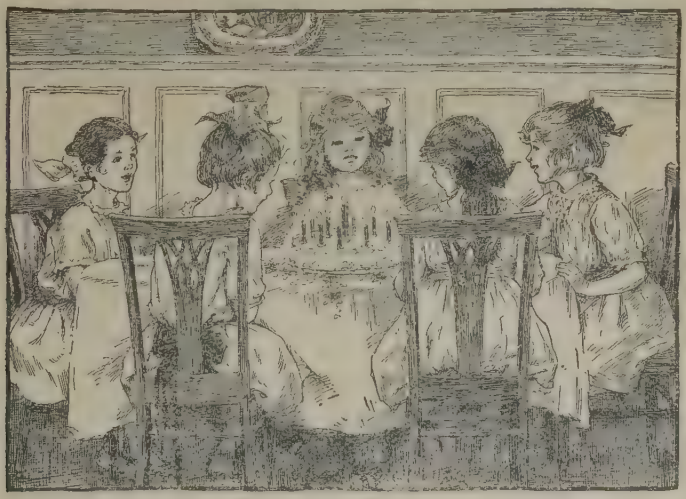
10. Mollie was told to go to the blackboard and mark off $\frac{1}{6}$ of the length. The blackboard was 19 ft. long, and she marked off 34 in. Was this too much or too little? How many inches should she have marked off?

A BIRTHDAY PARTY

All work oral

1. Miriam bought $\frac{3}{4}$ doz. small candles for her party. How many small candles did she buy?

2. Miriam paid 36¢ a dozen for the small candles. How much did she pay for the $\frac{3}{4}$ doz. small candles?



3. If Miriam paid 5¢ for the large candle in the center of her cake, how much did she pay for all the candles?

4. Miriam paid 50¢ for some candy, and her guests ate $\frac{4}{5}$ of it. How much did she pay for the candy for her guests?

5. In making the cake Miriam's mother used $\frac{2}{3}$ doz. eggs costing 54¢ a dozen. How much did she pay for the eggs?

6. Miriam's mother bought 1 doz. oranges at 60¢ a dozen. How much did 5 oranges cost for the party?

PROBLEMS WITHOUT NUMBERS

1. How do you change inches to feet?

2. How do you change feet to inches? to yards?

3. If you know how many quarts a can will hold, how do you find the number of pints?

4. If you know the number of gallons a pail will hold, how do you find the number of quarts?

5. How do you change pints to quarts? quarts to pints? gallons to quarts? quarts to gallons?

6. How do you find the number of seconds in an hour? the number of hours in a week?

7. How do you find the number of minutes in a day? in a week? in a year?

8. If you know the cost of milk by the quart, how do you find the cost by the gallon? by the pint?

9. If you know the area of the top of your desk in square feet, how do you find the area in square inches?

10. How do you find a fractional part of a number?

11. If you have a strip of braid, and have nothing with which to measure it, how do you proceed to cut off a quarter of it?

12. How do you find the number of pecks in a given number of bushels?

13. How do you find the number of pecks in a given number of quarts?

14. If you know the number of feet around a given running track, how do you find the number of yards?

VII. MINIMUM ESSENTIALS

WRITTEN EXERCISE

1. Write twenty-eight thousand in figures.
2. Write 90,370 in words.
3. Write two thousand dollars and six cents in figures.
4. Write the present year in Roman numerals.

Add the following:

5.		6.		7.		8.		9.	
89	42	638	87	802	72	342	05	332	75
78	96	742	36	643	96	728	08	742	87
9	30	900	48	817	55	69	73	698	98
45	56	6	52	223	08	800	12	942	37

Subtract, and check the work:

10.	11.	12.	13.	14.
60,872	40,201	81,234	72,350	93,468
23,968	39,875	16,942	49,873	68,090

15. How much greater is \$3050.70 than \$968.95?
16. Multiply \$5207.60 by 428; by 309; by 900.

Divide as follows:

17. $7800 \div 60$.
18. $9006 \div 79$.
19. $4700 \div 53$.
20. $6000 \div 17$.
21. $\$48.50 \div 25$.
22. $\$26.04 \div 42$.
23. Express 17 gal. as quarts; 17 qt. as gallons.
24. Find $\frac{3}{4}$ of 464, $\frac{3}{5}$ of 475, $\frac{5}{8}$ of 736, and $\frac{7}{8}$ of 984.

VIII. LITTLE EXAMINATIONS

I.	1. $6578 + 3969$.	5. 308×528.	9. $2889 \div 321$.
	2. $\$3.75 + \$8.68$.	6. 689×875.	10. $\frac{3}{4}$ ft. = (?) in.
	3. $4342 - 1968$.	7. $7380 \div 36$.	11. 80 gal. = (?) qt.
	4. 34×8603.	8. XCI = (?).	12. $\frac{1}{3}$ of 7296.
II.	1. $3983 + 6321$.	5. 386×986.	9. $3113 \div 283$.
	2. $\$4.87 + \$3.73$.	6. 970×692.	10. 1710 ft. = (?) yd.
	3. $5481 - 2968$.	7. $5330 \div 26$.	11. 80 qt. = (?) gal.
	4. 28×8461.	8. LXVI = (?).	12. $\frac{2}{3}$ of 3111.
III.	1. $3897 + 8564$.	5. 634×889.	9. $6084 \div 216$.
	2. $\$5.88 + \$7.96$.	6. 708×869.	10. 708 ft. = (?) yd.
	3. $8516 - 2398$.	7. $3999 \div 31$.	11. 60 pt. = (?) qt.
	4. 43×6974.	8. XVI = (?).	12. $\frac{3}{4}$ of 7284.
IV.	1. $3769 + 8872$.	6. 709×870.	11. 360 min. = (?) sec.
	2. $\$5.48 + \$6.89$.	7. $6996 \div 44$.	12. 80 qt. = (?) pt.
	3. $8812 - 3968$.	8. XXIV = (?).	13. 73 yd. = (?) ft.
	4. 79×9889.	9. $9000 \div 375$.	14. $\frac{3}{4}$ of 5640.
	5. 348×989.	10. 460×850.	15. $6132 \div 45$.
V.	1. $3278 + 6889$.	6. 986×898.	11. $8730 \div 194$.
	2. $\$4.39 + \$6.48$.	7. 450×720.	12. 360 sec. = (?) min.
	3. $9723 - 3658$.	8. $6384 \div 48$.	13. 6 lb. = (?) oz.
	4. 54×3947.	9. CXI = (?).	14. 32 oz. = (?) lb.
	5. 780×932.	10. CIX = (?).	15. 700×5280.

Teachers should read the note on page 46.

CHAPTER V

I. READING AND WRITING NUMBERS

REVIEW OF READING AND WRITING NUMBERS

Numbers 1 to 8, oral

1. In the number 74,036 what is the figure in units' place? in tens' place? in hundreds' place? in thousands' place? in ten-thousands' place?

2. In the number of this year what is the figure in units' place? in tens' place? in hundreds' place? in thousands' place?

Read each of these numbers:

3. 32,000.	5. 137,800.	7. 608,806.
4. 40,040.	6. 269,437.	8. 999,999.

Write the following numbers in figures:

9. Eighty-five thousand, two hundred sixteen.
10. Four hundred thousand, four hundred sixty-one.
11. Six hundred fifty-five thousand, seventy-nine.
12. Nine hundred ninety-nine thousand, nine hundred.

Write the following numbers in words:

13. 306,084.	15. 300,003.	17. 500,500.
14. 270,072.	16. 527,368.	18. 909,909.

Million. There is a special name for a thousand thousand. This number is called a *million*, and is written 1,000,000.

We count millions just as we count thousands. That is, 5,000,000 is 5 million, 273,000,000 is 273 million, and 170,050,270 is 170 million, 50 thousand, 270.

For easy reading we separate by commas the figures of a large number into groups of three, always beginning at the right, thus: 175,926,284. All these groups must have three figures, except the left-hand one; thus:

1,275,340	30,000,000	425,000,723
21,426,580	120,000,000	196,481,278

The name of the first group at the right is *units*; of the second group, *thousands*; of the third group, *millions*.

READING AND WRITING NUMBERS

Numbers 1 to 6, oral

Read these large numbers:

1. 1,234,567.
2. 3,486,000.
3. 34,296,890.
4. 68,080,008.
5. 328,289,000.
6. 846,928,875.

Write the following numbers in figures:

7. Thirteen million, two thousand, eighteen.
8. Seventy-two million, six hundred thirty.
9. Forty-two million, seven thousand, seven.
10. Five hundred sixty-seven million.
11. Four hundred fifteen million, seven hundred.
12. Nine million, three thousand, four hundred six.

II. ADDITION AND SUBTRACTION

REVIEW OF ADDITION

1. Georgia contains 59,265 square miles; Florida contains 58,666 square miles; and Alabama contains 51,998 square miles. What is the combined area of these states?

It is desirable to use such common expressions as "square miles" before the exact measure is studied.

2. A farmer sells six loads of hay. The first weighs 2580 lb.; the second, 2460 lb.; the third, 2340 lb.; the fourth, 1980 lb.; the fifth, 2270 lb.; the sixth, 1880 lb. How much do the six loads weigh together?

3. In a game of baseball the lengths of the several innings were 11 min., 13 min., 16 min., 9 min., 12 min., 15 min., 16 min., 10 min., and 14 min. John went into the grounds 20 min. before the game began and left 10 min. after the game ended. How many minutes was he in the grounds? How many hours and minutes?

Copy the following and add:

4.	5.	6.	7.
$328.75	$376.67	$983.68	$842.97
264.85	406.68	342.38	48.48
368.08	80.84	469.84	52.47
428.65	226.85	397.28	294.46
90.75	116.42	268.55	338.68
106.25	442.68	484.06	49.95
107.20	96.40	72.00	300.00
210.00	320.06	150.00	296.69

REVIEW OF SUBTRACTION

1. The owner of a garage had 680 gal. of gasoline and sold 195 gal. How many gallons had he left?

2. The owner of a garage had 320 gal. of gasoline at the beginning of a month. During the month he bought 1400 gal. more and sold 1270 gal. How many gallons had he left at the end of the month?

3. Last year 268 pupils left a certain city school and 397 new ones were admitted. At the end of the year there were 1428 pupils in the school. How many were there at the beginning of the year?

4. A certain freight elevator can safely carry 1800 lb. The elevator man weighs 196 lb., and he has 10 kegs of nails weighing 107 lb. each. How many more pounds can the elevator safely carry?

5. The manager of a moving-picture house took in $1834 last month, but out of that he paid $465 for pictures, $300 for rent, $480 for wages, and $235 for taxes and other expenses. How much had he left?

Subtract the following and check the work:

6.	7.	8.	9.
$814.03	$703.62	$833.20	$923.40
238.80	349.78	498.98	348.69

10. From the sum of $27,840.37 and $16,828.03 subtract the sum of $12,079.88 and $10,136.10. Check the work so as to be certain that the answer is right.

III. MULTIPLICATION AND DIVISION

REVIEW OF MULTIPLICATION

1. For a dress Kate's mother used 4 yd. of serge at \$1.12 a yard, and the trimming cost \$1.75. She paid \$3.50 for making the dress. What was the whole cost?

2. Fred has a job which pays him 85¢ for working Saturday afternoons. Each week he spends 30¢ and puts the rest of his wages into the savings bank. If he works 35 Saturdays of the year, how much does he put into the bank?

3. A bookkeeper receiving \$22.50 a week is promoted to a position paying \$125 a month. Counting 52 wk. as exactly 1 yr., how much more does he receive a year?

4. A man buys 36 acres of land at \$82.50 an acre, 60 acres at \$75 an acre, and 138 acres at \$112.50 an acre. How much does he pay for all the land?

Find the cost of the following purchases by dealers:

5. 134 yd. of Wilton carpet at \$2.15 a yard.
6. 268 yd. of silk at \$2.35 a yard; at \$2.85 a yard.
7. 108 building lots at \$1475 each; at \$1550 each.
8. 168 automobiles at \$1850 each; at \$1275 each.
9. 112 farm wagons at \$102.50 each; at \$112.50 each.

Multiply the following:

10. \$178.75 by 300; by 406; by 578; by 680.
11. \$1250.25 by 500; by 508; by 735; by 843.

Three-Figure Divisor. In a city the school superintendent wished to find the average weight of the boys in the fourth grade. Each boy was weighed and the weights were added, the sum being 12,705 lb. There were 231 boys. Find the average weight.

Since 231 boys weigh 12,705 lb., each boy weighs, on the average, 12,705 lb. ÷ 231.

Since $12 \div 2 = 6$, we might try 6 for the first figure of the quotient, but by looking a little ahead we see that this is too large.

Since $5 \times 231 = 1155$, we write 5 in tens' place and subtract 1155.

The remainder is again 1155, so we see that the units' figure in this quotient is the same as the tens' figure.

Proceeding as before, we find the quotient to be 55, so that the average weight of the boys is 55 lb.

If the quotient figure is taken too large, the partial product will be greater than the corresponding part of the dividend. In this case try a smaller quotient figure.

If the quotient figure is taken too small, the remainder will be greater than the divisor. In this case try a larger quotient figure.

We have here taken a case in which the quotient figures are alike, the pupil being more familiar with the other case from his study of division with two-figure divisors. No elaborate explanation is desirable yet, such work being reserved for a more advanced book. Habit formation and mechanical efficiency are the chief aims at this time.

DRILL WORK

Divide the following:

1. 16,250 ÷ 125.
2. 42,625 ÷ 125.
3. 38,000 ÷ 125.
4. 51,968 ÷ 232.
5. 77,720 ÷ 116.
6. 86,430 ÷ 201.
7. 76,859 ÷ 151.
8. 50,715 ÷ 245.
9. 93,808 ÷ 176.
10. 87,354 ÷ 211.
11. 94,107 ÷ 247.
12. 91,938 ÷ 199.
13. 85,407 ÷ 249.
14. 87,897 ÷ 249.
15. 87,549 ÷ 231.
16. 84,581 ÷ 281.
17. 18,250 ÷ 125.
18. 29,375 ÷ 125.
19. 41,875 ÷ 125.
20. 52,896 ÷ 116.
21. 52,576 ÷ 106.
22. 28,875 ÷ 231.
23. 70,738 ÷ 226.
24. 32,568 ÷ 118.
25. 79,756 ÷ 314.
26. 69,834 ÷ 226.
27. 72,885 ÷ 215.
28. 79,692 ÷ 229.
29. 82,644 ÷ 194.
30. 80,040 ÷ 232.

31. If 368 tons of coal cost $3312, what is the cost of the coal per ton?

32. If 308 sewing machines cost a dealer $16,016, how much did he pay for each machine?

33. If 196 machines cost a dealer $69,188, what is the cost of each machine?

Since three-figure divisors do not enter into the ordinary problems of the pupil's life at present, little besides abstract computation, as a kind of game, should be attempted.

Divisor ending in Zeros. There are 2000 lb. in a ton. A dealer sells coal to-day in small quantities amounting in all to 24,000 lb. How many tons does he sell? How many tons would he sell if there were 24,357 lb.? 25,357 lb.?

We wish to know how many 2000's there are in each of these numbers, and we divide as follows:

$$2000\overline{)24000} = 12 \qquad 2000\overline{)24357} = 12\tfrac{357}{2000} \qquad 2000\overline{)25357} = 12\tfrac{1357}{2000}$$

That is, we *cancel* (cross out) the zeros at the right of the divisor and cancel as many figures at the right of the dividend as we cancel zeros of the divisor, writing the complete remainder over the divisor.

Teachers will observe that this is a different use of the word "cancel" from that given later on pages 214 and 216.

Canceling the three zeros in 24,000 divides by 1000. Then dividing the rest by 2, we have divided by 2000.

The teacher should take up these three cases in order, showing that the numerator of the fraction, which term may be mentioned by name if desired, is the remainder in each case.

Such a fraction in a quotient is to be looked upon merely as an expression of division.

DIVISOR ENDING IN ZEROS

Divide the following:

1. $9000 \div 300$.
2. $9007 \div 300$.
3. $9107 \div 300$.
4. $64{,}000 \div 2000$.
5. $64{,}009 \div 2000$.
6. $64{,}109 \div 2000$.
7. $96{,}207 \div 3000$.
8. $306{,}000 \div 6000$.
9. $217{,}111 \div 7000$.
10. A car holding 100,000 lb. will hold how many tons?

Long Division of Dollars and Cents. 1. It costs a maker of dolls \$233.28 to manufacture 24 doz. dolls. How much do the dolls cost him apiece?

We see that 24 doz. $= 24 \times 12 = 288$.

To find the cost of each doll we must divide \$233.28 by 288.

Dividing in the usual way, we find that the quotient is \$0.81. This means that if we divide \$233.28 into 288 equal parts, there are 81¢ in each part.

$$\begin{array}{r} \$0.81 \\ 288\overline{)\$233.28} \\ 2304 \\ \hline 288 \\ 288 \\ \hline \end{array}$$

We see that it costs 81¢ to manufacture each doll.

2. To make 176 larger dolls the manufacturer finds that the cost is \$295.75.

To find the cost of manufacturing each doll we must divide \$295.75 by 176.

Dividing in the usual way, we find that the quotient is \$1.68 and the remainder is 7¢. This means that if we divide \$295.75 into 176 equal parts, there is \$1.68 in each part, and there is a remainder of 7¢ which is not divided. The quotient is $\$1.68\frac{7}{176}$, but such a small fraction as $\frac{7}{176}$ of a cent is usually neglected.

$$\begin{array}{r} \$1.68 \\ 176\overline{)\$295.75} \\ 176 \\ \hline 1197 \\ 1056 \\ \hline 1415 \\ 1408 \\ \hline 7 \end{array}$$

We see that it costs slightly more than \$1.68 to manufacture each of these dolls.

To check the work, we may take 7¢ from \$295.75 and show that the result is $176 \times \$1.68$; that is, $\$295.75 - \$0.07 = 176 \times \$1.68$.

USING WHAT YOU HAVE LEARNED

1. Mr. St. John, a furniture dealer, paid $851.20 for 112 tables. How much did he pay for each table?

2. A school sold 248 tickets for a school concert and received $37.20 in all. Frank's mother asked him how much the tickets cost apiece, but he had forgotten. How much did they cost?

3. A class of 18 had a picnic. They paid $1.80 for trolley tickets, $2.70 for lunches, and $1.44 for ice cream. What was the expense for each child?

4. In a certain school there are 336 pupils in 12 classes of the lower grades, and 231 pupils in 9 classes of the upper grades. What is the average number of pupils in each class of the whole school?

5. Mr. Sims, the grocer, receives a crate holding 480 eggs. He finds that 7 eggs are broken, and he puts the rest into boxes holding a dozen each. How many boxes can he fill, and how many eggs will be left over?

6. A coal dealer sold 148,000 lb. of coal in one day. At 2000 lb. to a ton, how many tons did he sell?

7. A dealer had 179 tons of coal when the weather turned cold, and he could get no more. He delivered 17 tons to each of 4 apartment houses and 3 tons to each of 20 families. He divided the rest equally among 17 families. How much did each of these families get?

Divide, finding the quotients, and remainders if any:

8. $633.60 ÷ 198.

9. $1555.20 ÷ 144.

IV. MEASURES

MEASURING LENGTH

1. See how near you can come to estimating the length and the width of your schoolroom.

Estimate the following:

2. The width of the door in feet and inches.
3. The height of the chalk rack above the floor.
4. The height of the door and the height of the room.
5. The width of the street in front of the schoolhouse.
6. The length of step that you take in ordinary walking.
7. Read and learn the following table of length:

12 inches (in.) = 1 foot (ft.)
3 feet = 36 inches = 1 yard (yd.)
$5\frac{1}{2}$ yards = $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods = 5280 feet = 1 mile (mi.)

The teacher should assist the pupils to visualize these basal units. In cities the number of blocks to the mile, the number of feet or rods in the width of the streets, and the average size of building lots should be known. In the country the rod and the mile are of particular importance in measuring the size of fields and the distance to the village.

In the same way teachers should make sure that the pupils have a definite idea of the value of each item in the various other tables, and should fix these ideas of values by frequent reviews and drills in which the words are used concretely. They should use the blackboard, the schoolroom floor, and the school yard to illustrate distances and areas. The pupils should learn to pace distances. The distance from the school to some well-known point should be fixed as a standard mile to which the pupils can refer in making estimates. Much practice in estimating should be given, and the estimates should be followed by actual measurements.

USING WHAT YOU HAVE LEARNED

Numbers 1 to 4, oral

1. A blackboard 9 ft. long is how many yards long?

2. If a blackboard is 1 yd. wide, it is how many feet wide? how many inches wide?

3. A driveway from the road to a farmhouse is 1 rd. wide. How many feet is this?

4. In measuring the sidewalk in front of the schoolhouse a class found that the width lacked 1 ft. of being 2 yd. Express the width in feet.

5. In measuring land, surveyors often use a chain that is 66 ft. long. How many chains are there in 1 mi.?

6. A farmer has a meadow that is $\frac{1}{4}$ mi. long. How many rods long is the meadow?

7. If the meadow in Ex. 6 is half as wide as it is long, how many rods wide is the meadow?

8. Tom has an express wagon in which each wheel is 6 ft. around. How many times does each wheel turn in going 1 mi.?

Attention should be called to the fact that this is the principle of the common meters in an automobile.

9. How many inches are there in 16 ft.? in $\frac{1}{2}$ ft.? Then how many inches are there in $16\frac{1}{2}$ ft., or 1 rd.?

10. How many feet are there in $\frac{1}{2}$ mi.?

11. We do not need to use the number of inches in a mile, but it is interesting to find what this number is. What is the number?

MEASURING AREA

Numbers 1 to 9, oral

1. What is the area of a square that is 1 ft. on a side? Draw such a square on the blackboard.

2. What is the area of a square that is 2 ft. on a side? Draw such a square on the blackboard.

State rapidly the areas of squares whose sides are:

3. 3 ft. **4.** 4 ft. **5.** 8 in. **6.** 1 yd. **7.** 12 in.

8. How many square feet are there in 1 sq. yd.?

9. Read and learn the following table:

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

In the country special care should be taken to visualize the acre by pointing out fields that contain an acre or a definite number of acres.

10. How many times is 9 sq. ft. contained in 144 sq. ft.? How many square yards in 144 sq. ft.?

11. How many square yards in a rectangle 12 yd. by 20 yd., that is, 12 yd. wide and 20 yd. long?

Find the areas of the following rectangles:

12. 28 ft. by 42 ft.
13. 38 yd. by 64 yd.
14. 68 ft. by 140 ft.
15. 24 yd. by 36 yd.
16. 48 ft. by 96 ft.
17. 64 ft. by 288 ft.

Unit of Measure. When we measure length by the foot we call the foot the *unit of measure*. So if we measure weight by the pound, the pound is the unit of measure.

In measuring great lengths we use the mile as the unit. For lengths less than 1 mi. we often use the rod or the yard. For short lengths we use the foot or the inch.

UNIT OF MEASURE

Numbers 1 to 4, oral

1. If you speak of the length of your state, do you speak of it by miles or by feet?

2. If you measure your schoolroom, do you measure by miles, by feet, or by inches?

3. If you measure your finger, do you measure by yards, by feet, or by inches?

4. If asked your age, do you answer in years or in weeks? If asked how long before you go home to-day, how do you answer?

5. Measure the length of the room, using 1 ft. as the unit; using 1 yd. as the unit.

6. Measure the length of your desk, using 1 ft. as the unit; using 1 in. as the unit.

7. Measure the height of your desk, using 1 ft. as the unit; using 1 in. as the unit.

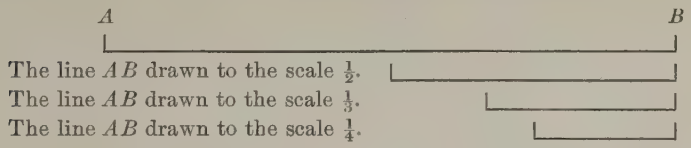
8. Imagine a square 36 in. on a side. Find its area, using 1 sq. ft. as the unit of measure; using 1 sq. yd. as the unit; using 1 sq. in. as the unit.

DRAWING TO SCALE

Numbers 1 to 5, oral

1. If we draw a picture of a doll's house and make it $\frac{1}{4}$ as long and $\frac{1}{4}$ as high as the house, we say that we draw the picture to the *scale* of 1 to 4, or to the scale $\frac{1}{4}$. Every inch in length is then represented by $\frac{1}{4}$ in. What do we mean by saying that we draw to the scale $\frac{1}{8}$?

2. We may draw to other scales. If we represent 1 ft. by 1 in., we say that we draw to the scale of 1 in. to 1 ft. Since there are 12 in. in 1 ft., we also say that we draw to the scale of 1 to 12, writing this as the scale $\frac{1}{12}$.



We frequently write 4′ for 4 ft., 4″ for 4 in., 4′ 8″ for 4 ft. 8 in., and so on. What does 3′ 4″ mean?

3. If we draw to the scale $\frac{1}{2}$, by what length shall we represent a line 8 in. long?

4. If we draw to the scale $\frac{1}{3}$, by what length shall we represent a line 12 in. long? a line 18 in. long?

5. If we draw to the scale $\frac{1}{4}$, by what length shall we represent a line 20 in. long? a line 32 in. long?

Draw lines representing these lengths to the given scales:

6. 12 in., $\frac{1}{2}$.

7. 12 in., $\frac{1}{3}$.

8. 16 in., $\frac{1}{4}$.

9. 24 in., $\frac{1}{4}$.

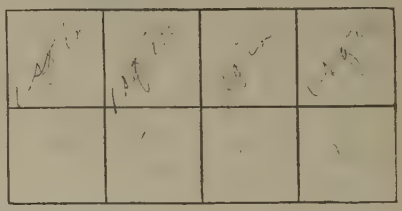
10. 24 in., $\frac{1}{3}$.

11. 24 in., $\frac{1}{6}$.

DRAWING TO SCALE

Numbers 1 to 5, oral

1. Here is a rectangle $2''$ long by $1''$ wide. It is divided into eight squares, each of which is $\frac{1}{2}''$ on a side.



If we make a drawing of this rectangle, making each line half as long as it is here, we have the lower rectangle. We say that we have drawn the rectangle to the scale $\frac{1}{2}$, to the scale of $1''$ to $2''$, or to what other scale?

2. A plan of a box lid is drawn to the scale $\frac{1}{2}$. The drawing is $6''$ long. What is the length of the box lid?

3. In a plan of a floor the scale is $1''$ to $1'$. The plan is $16''$ by $18''$. What is the size of the floor?

4. A drawing is made of a leaf of a notebook. The drawing is $2''$ by $3''$ and the scale is $\frac{1}{3}$. What are the dimensions of the leaf?

5. A drawing is made of the cloth back used in binding a book. The drawing is $1''$ by $3''$ and the scale is $\frac{1}{4}$. What are the dimensions of the cloth?

Draw the plans mentioned above in:

6. Ex. 2. **7.** Ex. 3. **8.** Ex. 4. **9.** Ex. 5.

10. Draw to scale a plan of the floor of your schoolroom.

REVIEW OF AREAS

1. Measure to the nearest inch the length and width of this page, find the area, and make a drawing of the page to the scale $\frac{1}{2}$.

2. Measure to the nearest inch the top of your desk and find the area. Make a drawing of the top of the desk to the scale $\frac{1}{8}$.

3. Frank makes a drawing of a baseball diamond, each side being 9 in. If the real baseball diamond is 90 ft. on each side, what scale does Frank use? Make the drawing.

4. On one wall of a schoolroom there is a space 4 ft. long and 18 in. high for the exhibition of drawings. If each drawing is 6 in. wide by 9 in. high, how many drawings can be placed in this space? Make a drawing to the scale of 1 in. to 1 ft., showing how the pictures will be placed in the space.

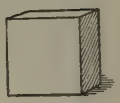
5. A flower bed in the park is 20 yd. long and 12 yd. wide. How many square yards does it contain? Draw a plan to the scale of 1 in. to 4 yd.

6. A sidewalk is 136 ft. long and 5 ft. wide. How many square feet of area in the walk?

Find the areas of the following rectangles:

7. 8 ft. by 18 ft.
8. 16 ft. by 28 ft.
9. 21 in. by 54 in.
10. 16 yd. by 36 yd.
11. 18 ft. by 76 ft.
12. 34 in. by 48 in.
13. 68 in. by 84 in.
14. 36 yd. by 48 yd.

Cubic Measure. If a block is 1 in. long, 1 in. wide, and 1 in. high, its *volume* is 1 cubic inch.



If each edge is 1 ft., the volume is 1 cubic foot; and if each edge is 1 yd., the volume is 1 cubic yard.

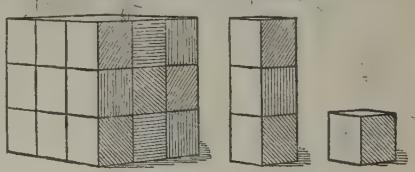
TABLE OF CUBIC MEASURE

All work oral

1. In the picture shown below, the cube A is how many times the block B?

2. The block B is how many times the cube C?

3. A cube that is 3 ft. on an edge is how many times as large as a cube that is 1 ft. on an edge?



4. How many feet in 1 yd.? Then how many cubic feet in 1 cubic yard?

5. How would you find the number of cubic inches in 1 cubic foot? Show on the blackboard how to do the work.

6. Read, learn, and recite this table:

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)

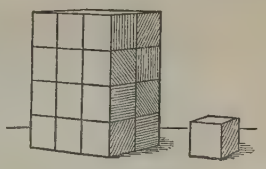
27 cubic feet = 1 cubic yard (cu. yd.)

The teacher should see that the pupils understand informally the meaning of the words *cube*, *solid*, *volume*, and *dimensions*, and should state to the class that the blocks and boxes which we shall measure have square corners. Such a long term as *rectangular solid* need not be used at this time. It should also be explained that we may have a volume of 1 cu. ft. without having a cube; thus a pail may have a volume of 1 cu. ft.

FINDING VOLUMES

Numbers 1 to 5, oral

1. Here is the picture of a block 3 in. long, 2 in. wide, and 4 in. high. How many cubic inches in the block?



Since a block 1 in. long, 1 in. wide, 1 in. high contains 1 cu. in., a block 3 times as long contains 3×1 cu. in., or 3 cu. in.; a block 2 times as wide contains 2×3 cu. in., or 6 cu. in.; and a block 4 times as high contains 4×6 cu. in. That is, $2 \times 3 \times 4$ cu. in. = how many cubic inches?

2. How many cubic inches are there in a block 4 in. long, 3 in. wide, and 2 in. high? in a block 5 in. long, 4 in. wide, and 2 in. high?

3. How many cubic yards in a cellar 5 yd. by 12 yd. by 2 yd.? in a cellar 4 yd. by 5 yd. by 3 yd.?

4. How many cubic inches in a box 2 in. by 4 in. by 5 in.? in a box 2 in. by 5 in. by 7 in.?

5. How many cubic inches in a cube 10 in. on an edge?

6. How many cubic inches in an aquarium 18 in. long, 10 in. wide, and 9 in. deep?

7. How many cubic feet in a wall 38 ft. long, 8 ft. high, and 2 ft. thick?

8. A cistern is 8 ft. square at the bottom and 6 ft. deep. How many cubic feet of water will it contain?

9. A water tank is 9 ft. long, 8 ft. wide, and 5 ft. deep. How many cubic feet of water will it contain?

MEASURING WOOD

All work oral

1. This boy is 4 ft. tall. Estimate the dimensions of this woodpile. Do you know the name of this amount of wood?

2. A pile of wood is 8 ft. long, 4 ft. wide, and 4 ft. high. How do you find the number of cubic feet it contains?

3. Read, learn, and recite this table:

128 cubic feet = 1 cord (cd.)

4. Stand 8 ft. from the front of the room and 4 ft. from the side, and hold your hand 4 ft. from the floor, so as to show the size of a cord. What is sold by the cord?

5. How much will 9 cd. of wood cost at $7 a cord?

6. How much will 7 cd. of wood cost at $8 a cord?

7. How many cords of wood in a pile 16 ft. long, 4 ft. wide, and 8 ft. high?

SELLING THINGS BY WEIGHT

Numbers 1 to 4, oral

1. Butter is sold by the pound. Cheese is sold by the pound. Pepper is sold by the ounce. Do you know how coal is sold? Do you know how hay is sold?

2. Can you name anything else that is sold by the ounce? by the pound? by the ton?

3. Read, learn, and recite this table:

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

4. What measures of weight are used in selling straw? candy? printing paper? cloves? meat? iron?

5. At \$18.75 a ton, how much will 16 T. of hay cost? How much will 24 T. cost?

6. At \$8.50 a ton, how much will 64 T. of coal cost? How much will 80 T. cost?

7. At \$53.40 for 6 T., how much will 1 T. of coal cost? How much will 7 T. cost?

8. When coal is worth \$9.25 a ton, how much will 16 T. cost? How much will 24 T. cost?

9. When hay is worth \$19.25 a ton, how much will 7 T. cost? How much will 24 T. cost?

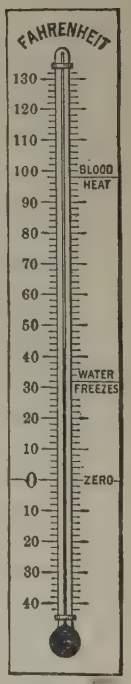
10. How much will 17 T. of coal cost at \$8.75 a ton?

11. How much will 26 T. of coal cost at \$8.95 a ton? at \$7.30 a ton? at \$7.80 a ton? at \$6.25 a ton?

12. What is hay worth when 21 T. cost \$270.90?

Measuring Temperature. We measure heat by using an instrument called a *thermometer*.

If you put a thermometer in a mixture of salt and chopped ice, the top of the mercury or the colored liquid sinks to zero.



If you put a thermometer in water just as the water is freezing, the top of the mercury or the colored liquid is at a point marked 32. This point is known as 32 degrees above zero. We write 32 degrees like this: 32°.

If you put the thermometer bulb under your tongue and close your lips around it, the top of the mercury or the colored liquid is at 98°.

If the thermometer is large enough and you hold it for a time in boiling water, the top of the mercury indicates 212°.

Our government advises us to keep our houses and schools at 68° or lower during the winter. It wastes fuel and is not healthful for us to keep the temperature of a closed room above 68°. In the summer, when the windows are open or when we are out of doors, a higher temperature is not ordinarily harmful.

The amount of computation in connection with the thermometer is very slight. Teachers should, however, have the pupils keep records of the temperature in the school and out of doors for a few days and make sure that the reading of the thermometer is understood. In those parts of the country where the temperature frequently falls below zero, pupils may be told that $-4°$ means 4° below zero, read also "minus 4°."

REVIEW OF MEASURES

Numbers 1 to 4, oral

1. What is the temperature in your room to-day?

2. If the temperature out of doors on a certain day is 40° and the temperature in school is 67°, how much warmer is it in school than out of doors?

3. In the northern part of our country the temperature out of doors one winter's day was 10° below zero. How many degrees higher would the mercury stand in a house where the temperature was 60°?

Remember that it must rise 10° to reach 0, and then must rise 60°.

4. In one of our northern cities the temperature was 10° below zero on the coldest day of the winter one year, and 106° above zero on the hottest day of the summer. What was the difference in the temperature?

This is a case in which we find a difference in temperature by finding the sum of two numbers.

Express the following as quarts:

5. 60 gal.	7. 44 pt.	9. 180 gal.	11. $\frac{1}{2}$ gal.
6. 140 gal.	8. 38 pt.	10. 180 pt.	12. $1\frac{1}{2}$ gal.

Express the following as feet:

13. 24 in.	14. 24 yd.	15. 36 in.	16. 36 yd.

Express the following as inches:

17. $\frac{1}{2}$ ft.	18. 7 ft.	19. $\frac{1}{4}$ yd.	20. 7 yd.

21. Find the number of gallons in 168 qt.; in 200 qt.

REVIEW OF MEASURES

Numbers 1 to 10, oral

1. A pint of cream is how many gills of cream?
2. A gallon of cream is how many pints of cream?
3. In 16 qt. there are how many gallons?
4. In 3 bu. there are how many pecks?
5. How many quarts are there in 6 pk.?
6. There are how many ounces in $\frac{1}{2}$ lb.? in $\frac{1}{4}$ lb.?
7. A boy is 4 ft. high. What is his height in inches?
8. How many inches are there in 3 ft.? in $\frac{1}{2}$ yd.?
9. How many pounds are there in 2 T.? in 3 T.?
10. In 4 sq. yd. there are how many square feet?
11. It is claimed that school buildings should allow 15 sq. ft. of floor space for every pupil in a room. If a room is 24 ft. by 36 ft., what is the greatest number of pupils that it should contain if the claim is correct?

The pupils should measure their classroom and determine its capacity according to this standard. They should also learn to apply common sense to an answer involving a fraction, rejecting the fraction entirely in a case of this kind.

12. A builder wishes to cover the floor of a bathroom 9 ft. long and 6 ft. wide with tiles each 2 in. square. How many tiles must he order?
13. How many minutes before 10 is 38 min. after 9?
14. Write the number of days in a year. Then divide this number by the number of days in a week, so as to find the number of weeks in a year.

V. FRACTIONS

Terms of a Fraction. To take $\frac{3}{8}$ of this rectangle we divide the rectangle into 8 equal parts and take 3 of these equal parts.

In the fraction $\frac{3}{8}$ the number 8 is called the *denominator*, and it tells the number of equal parts into which the unit, in this case the rectangle, has been divided.

In the same fraction $\frac{3}{8}$ the number 3 is called the *numerator*, and it tells how many equal parts are taken.

$$\frac{3 = \text{numerator}}{8 = \text{denominator}}$$

The numerator and denominator are called the *terms* of the fraction. The terms of the fraction $\frac{3}{8}$ are 3 and 8.

A whole number, like 2 or \$10, is called an *integer*.

An integer and a fraction taken together, like $2\frac{1}{2}$ or $4\frac{3}{4}$ ft., is called a *mixed number*.

A fraction that is less than 1, like $\frac{1}{2}$, $\frac{3}{4}$, or $\frac{2}{5}$, is called a *proper fraction*.

A fraction that is equal to 1, like $\frac{4}{4}$ or $\frac{5}{5}$, or greater than 1, like $\frac{5}{4}$ or $1\frac{5}{8}$, is called an *improper fraction*.

We see that we can write improper fractions as whole numbers or as mixed numbers. For example,

$$\frac{4}{4}=1 \qquad \frac{5}{4}=1\frac{1}{4} \qquad \frac{5}{5}=1 \qquad \frac{8}{5}=1\frac{3}{5} \qquad \frac{6}{6}=1 \qquad \frac{11}{6}=1\frac{5}{6}$$

It should be repeated that definitions such as those given above need not be learned, but the terms should be used properly. The chief consideration is that the meaning should be understood by the pupils.

REVIEW OF FRACTIONS

All work oral

1. In the fraction $\frac{3}{4}$ which number is the denominator? What does it tell about the fraction? Which is the numerator, and what does it tell about the fraction?

2. State the integers in this list: $\frac{3}{8}$, 6, $4\frac{7}{8}$, 1, $9\frac{1}{2}$, 26.

3. State the mixed numbers in this list: $\frac{6}{2}$, $4\frac{1}{2}$, $3\frac{2}{3}$, 8.

4. State the proper fractions in this list: $\frac{3}{2}$, $\frac{1}{2}$, $\frac{4}{2}$, $\frac{5}{12}$.

5. State the improper fractions in this list: $\frac{3}{2}$, $\frac{5}{5}$, $\frac{3}{4}$, $\frac{9}{5}$.

6. Find $\frac{2}{3}$ of 9; of 12; of 21; of 30; of 36.

7. A grocer had a box of 120 apples and sold $\frac{2}{3}$ of them. How many apples did he sell?

8. Find $\frac{3}{4}$ of 4; of 16; of 20; of 36; of 48; of 80.

9. A fruit dealer had a box of 120 grapefruits and sold $\frac{1}{3}$ of them. How many did he sell, and how many did he have left?

10. If you pay 40¢ for 1 lb. of butter, how much will you pay for $\frac{1}{4}$ lb.? How much will you pay for $\frac{3}{4}$ lb.? How much will you pay for $1\frac{1}{4}$ lb.?

11. Find $\frac{3}{5}$ of 10; of 15; of 30; of 40; of 50; of 60.

12. Find $\frac{5}{6}$ of 6; of 12; of 30; of 36; of 60; of 66.

13. Find $\frac{5}{8}$ of 16; of 24; of 32; of 40; of 80; of 88.

14. Find $\frac{3}{10}$ of 20; of 40; of 70; of 90; of 110; of 120.

15. Find $\frac{1}{12}$ of 24; $\frac{5}{12}$ of 60; $\frac{7}{12}$ of 72; $\frac{11}{12}$ of 120.

The fractions which the pupils will actually meet rarely have other denominators than 2, 3, 4, 8, and 12, and very rarely one greater than 16.

Multiplying by a Mixed Number. If 1 lb. of butter costs 44¢, how much will $2\frac{3}{4}$ lb. cost?

We see that $2\frac{3}{4}$ lb. will cost $2\frac{3}{4} \times 44¢$.

We multiply 44 by $2\frac{3}{4}$ like this:

$\frac{1}{4}$ of 44 = 11, and so $\frac{3}{4}$ of 44 is 3×11, or 33. We write the 33 below the line under the 2.

$2 \times 44 = 88$, and we write the 88 below the 33 as shown.

$88 + 33 = 121$, and therefore the cost is 121¢, or \$1.21.

44
$2\frac{3}{4}$
33
88
121

MAKING PURCHASES

Numbers 1 to 5, oral

1. If you go to the store and buy $1\frac{1}{4}$ lb. of butter at 40¢ a pound, how much must you pay?

2. Find the cost of $1\frac{1}{2}$ doz. eggs at 44¢ a dozen.

Find the cost of the following:

3. $1\frac{1}{2}$ doz. eggs at 60¢ a dozen.

4. $2\frac{1}{2}$ lb. of cheese at 40¢ a pound.

5. How do you multiply 88¢ by $2\frac{3}{4}$? In showing how you would do this, place the work on the blackboard.

Multiply the following:

6. $1\frac{1}{2} \times 18¢$.
7. $1\frac{1}{2} \times 24¢$.
8. $1\frac{1}{2} \times 38¢$.
9. $2\frac{1}{2} \times 46¢$.
10. $4\frac{1}{2} \times 64¢$.
11. $1\frac{1}{2} \times 96¢$.
12. $2\frac{2}{3} \times 96¢$.
13. $3\frac{3}{4} \times 96¢$.
14. $4\frac{3}{8} \times 96¢$.
15. $3\frac{5}{8} \times 96¢$.
16. $3\frac{2}{3} \times 15$ ft.
17. $4\frac{7}{8} \times 16$ yd.
18. $6\frac{3}{4} \times 24$ in.
19. $8\frac{7}{8} \times 32$ lb.
20. $6\frac{1}{12} \times 48$ doz.

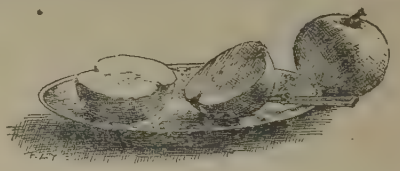
ADDING AND SUBTRACTING FRACTIONS

All work oral

1. How many halves of an apple in 1 apple?

2. How many halves of an apple in 2 apples? in $2\frac{1}{2}$ apples? in $3\frac{1}{2}$ apples?

3. There are how many whole apples in $\frac{2}{2}$ of an apple? in $\frac{6}{2}$ apples? in $\frac{4}{2}$ apples? in $\frac{10}{2}$ apples?



4. How many inches are $1\frac{1}{2}$ in. + $\frac{1}{2}$ in.? $1\frac{1}{2}$ in. + $1\frac{1}{2}$ in.? $3\frac{1}{2}$ in. + $\frac{1}{2}$ in.? $3\frac{1}{2}$ in. + $2\frac{1}{2}$ in.? $5\frac{1}{2}$ in. + $3\frac{1}{2}$ in.?

5. If Harriet needs $2\frac{1}{2}$ yd. of cloth for some sewing and has $3\frac{1}{2}$ yd., how much has she to spare?

State the result of each of the following:

6. $3\frac{1}{2} + \frac{1}{2}$.
7. $3\frac{1}{2} + 3\frac{1}{2}$.
8. $4\frac{1}{2} + 2\frac{1}{2}$.
9. $7\frac{1}{2} - \frac{1}{2}$.
10. $9\frac{1}{2} - 3$.
11. $6\frac{1}{2} - 3\frac{1}{2}$.
12. $8\frac{1}{2} + 4\frac{1}{2}$.
13. $8\frac{1}{2} - 4\frac{1}{2}$.

14. How much is $\frac{1}{4}$ of this square and $\frac{3}{4}$ of the square? If $\frac{1}{4}$ in. + $\frac{3}{4}$ in. = 1 in., how much is $\frac{1}{4}$ ft. + $\frac{3}{4}$ ft.? $\frac{1}{4}$ lb. + $\frac{3}{4}$ lb.?

15. If you have $\frac{3}{4}$ yd. of ribbon and sew $\frac{1}{4}$ yd. more on the end, how long is the ribbon?

16. How much is $\frac{1}{3}$ of this circle and $\frac{2}{3}$ of the circle? If $\frac{1}{3}$ in. + $\frac{2}{3}$ in. = 1 in., how much is $\frac{1}{3}$ yd. + $\frac{2}{3}$ yd.?

17. How much is $\frac{1}{5} + \frac{4}{5}$? $\frac{2}{5} + \frac{3}{5}$? $\frac{1}{6} + \frac{5}{6}$?

18. How much is $\frac{1}{8} + \frac{7}{8}$? $\frac{3}{8} + \frac{5}{8}$? $\frac{3}{10} + \frac{7}{10}$? $\frac{5}{16} + \frac{11}{16}$?

Reduction. Suppose that John is making a picture frame and puts a strip of gilt molding $\frac{1}{2}$ in. wide beside a strip of black molding $\frac{3}{4}$ in. wide. If John wishes to find the total width, he can add $\frac{1}{2}$ in. and $\frac{3}{4}$ in., but this is not so easy as to add $\frac{1}{4}$ and $\frac{3}{4}$. We can add 1 in. and 3 in., or 1 ft. and 3 ft., but to add 1 in. and 3 ft. we must either make them both inches, and say 1 in. + 36 in. = 37 in.; or make them both feet, and say $\frac{1}{12}$ ft. + 3 ft. = $3\frac{1}{12}$ ft.

So here, we must make $\frac{1}{2}$ and $\frac{3}{4}$ both halves or both fourths. Let us see how this is done.

How many fourths of this square do you see in $\frac{1}{2}$ of the square? Then $\frac{1}{2}$ is the same as how many fourths?

We see that $\frac{2}{4}$ can be obtained from $\frac{1}{2}$ by multiplying both terms by 2, and that $\frac{1}{2}$ can be obtained from $\frac{4}{8}$ by dividing both terms by 4. That is,

Both terms of a fraction may be multiplied by the same number without changing the value of the fraction.

Both terms of a fraction may be divided by the same number without changing the value of the fraction.

When we change the value of the terms without changing the value of a fraction, we *reduce* the fraction.

When we say that $\frac{1}{2} = \frac{4}{8}$, we reduce the fraction $\frac{1}{2}$ to eighths. When we say that $\frac{5}{10} = \frac{1}{2}$, we reduce the fraction $\frac{5}{10}$ to halves.

When both terms cannot be divided by the same number, the fraction is said to be *in lowest terms*.

The fraction $\frac{6}{8}$ becomes $\frac{3}{4}$ when it is reduced to lowest terms.

How to Reduce Fractions. From what we studied on page 213 we have the following rule:

To reduce a fraction to lowest terms divide both terms by the largest number that divides them both without remainder.

$$\frac{8}{12} = \frac{8 \div 4}{12 \div 4} = \frac{2}{3}, \text{ lowest terms.}$$

In this example, 4 is said to be *canceled* from both terms when the work is written in the form shown at the right. We write all fractions in lowest terms unless otherwise directed.

$$\frac{\overset{2}{\cancel{8}}}{\underset{3}{\cancel{12}}} = \frac{2}{3}$$

REDUCING FRACTIONS

1. Which of these pictures shows that $\frac{3}{6} = \frac{1}{2}$? Which shows that $\frac{2}{6} = \frac{1}{3}$? Write two equal fractions that you find from studying picture *B*.

2. Write two equal fractions that you find from studying picture *C*.

Draw lines and divide them into parts to show that:

3. $\frac{1}{4} = \frac{2}{8}$.
4. $\frac{6}{8} = \frac{3}{4}$.
5. $\frac{4}{6} = \frac{2}{3}$.
6. $\frac{3}{6} = \frac{1}{2}$.
7. $\frac{1}{3} = \frac{2}{6}$.
8. $\frac{1}{2} = \frac{3}{6}$.
9. $\frac{4}{10} = \frac{2}{5}$.
10. $\frac{5}{10} = \frac{1}{2}$.
11. $\frac{6}{10} = \frac{3}{5}$.
12. $\frac{8}{10} = \frac{4}{5}$.
13. $\frac{4}{12} = \frac{1}{3}$.
14. $\frac{6}{12} = \frac{1}{2}$.

Draw squares and divide them into parts to show that:

15. $\frac{1}{2} = \frac{2}{4}$.
16. $\frac{2}{2} = \frac{4}{4}$.
17. $\frac{1}{2} = \frac{4}{8}$.
18. $\frac{2}{2} = \frac{8}{8}$.
19. $\frac{1}{4} = \frac{2}{8}$.
20. $\frac{2}{4} = \frac{4}{8}$.
21. $\frac{3}{4} = \frac{6}{8}$.
22. $\frac{4}{4} = \frac{8}{8}$.

REDUCING FRACTIONS

All work oral

1. Reduce the following fractions to halves:

$\frac{2}{4}$ $\frac{4}{8}$ $\frac{8}{8}$ $\frac{12}{8}$ $\frac{16}{8}$ $\frac{24}{8}$ $\frac{32}{8}$ $\frac{40}{8}$

2. Reduce the following fractions to fourths:

$\frac{1}{2}$ $\frac{2}{8}$ $\frac{4}{8}$ $\frac{16}{8}$ $\frac{10}{8}$ $\frac{20}{8}$ $\frac{18}{8}$ $\frac{22}{8}$

3. Reduce the following fractions to eighths:

$\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{4}$ $\frac{4}{4}$ $\frac{6}{4}$ $\frac{7}{2}$ $\frac{2}{16}$ $\frac{4}{16}$

4. Reduce the following fractions to twelfths:

$\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{4}$ $\frac{1}{3}$ $\frac{2}{3}$ $\frac{1}{6}$ $\frac{5}{6}$ $\frac{2}{24}$

5. Reduce the following fractions to lowest terms:

$\frac{2}{4}$ $\frac{4}{8}$ $\frac{2}{8}$ $\frac{8}{10}$ $\frac{3}{6}$ $\frac{4}{6}$ $\frac{6}{8}$ $\frac{5}{10}$

6. Express $\frac{1}{3}$ in. and $\frac{1}{2}$ in. as sixths of an inch, and tell which is the greater.

7. Express $\frac{1}{3}$ in. and $\frac{1}{4}$ in. as twelfths of an inch, and tell which is the greater.

8. Express as sixths: $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{2}{3}$.

9. Express as tenths: $\frac{1}{2}$, $\frac{1}{5}$, $\frac{3}{5}$, $\frac{2}{5}$, and $\frac{4}{5}$.

10. Express as fifteenths: $\frac{1}{3}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$, $\frac{2}{3}$, and $\frac{3}{5}$.

11. Express as sixteenths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{7}{8}$, $\frac{3}{4}$, $\frac{3}{8}$, and $\frac{5}{8}$.

12. Express $\frac{4}{8}$ as halves; as fourths; as sixteenths.

13. Reduce $\frac{8}{8}$ to halves; to fourths; to sixteenths.

14. How many fourths in $\frac{2}{4}$? in $\frac{1}{2}$? in $\frac{2}{2}$?

15. How many eighths in $\frac{4}{8}$? in $\frac{1}{2}$? in 1? in 2? in 3?

16. How many twelfths in $\frac{6}{12}$? in $\frac{1}{2}$? in 1? in 3?

Cancellation. A room 15 ft. by 18 ft. and an entrance hall 3 ft. by 9 ft. are both to have new ceilings. The area of the first ceiling is how many times that of the second ceiling?

We see that we may find the two areas, and then divide the first by the second.

There is a shorter way, however. We may write 15×18 as the numerator of a fraction, and 3×9 as the denominator of the fraction, and then cancel as here shown.

$$\frac{\overset{5}{\cancel{15}} \times \overset{2}{\cancel{18}}}{\underset{}{\cancel{3}} \times \underset{}{\cancel{9}}} = 10$$

The answer is 10, and so the area of the first ceiling is 10 times that of the second.

SAVING WORK BY CANCELLATION

1. If 9 hats cost \$27, how much will 4 hats cost?

Show the class that 1 hat will cost $\frac{\$27}{9}$, and that 4 hats will cost 4 times as much, or $\frac{4 \times \$27}{9}$. Then obtain the result by cancellation.

In all such problems it should be remembered that the words "at the same rate" are understood.

2. If 7 desks cost \$56, how much will 11 desks cost?

Find the value of each of the following, and write a problem about each:

3. $\frac{18 \times 5}{9}$.

4. $\frac{27 \times 8}{9}$.

5. $\frac{18 \times 25}{5}$.

6. $\frac{16 \times 21}{7}$.

7. $\frac{15 \times 21}{5 \times 7}$.

8. $\frac{21 \times 24}{7 \times 8}$.

Reduction of an Improper Fraction to a Mixed Number. If you have $\frac{3}{4}$ yd. of ribbon and buy $\frac{3}{4}$ yd. more, how much ribbon will you have?

Just as $3¢ + 3¢ = 6¢$,

so $\frac{3}{4} + \frac{3}{4} = \frac{6}{4}$,

and so you will have $\frac{6}{4}$ yd. of ribbon.

But how many yards are there in $\frac{6}{4}$ yd. of ribbon?

Let us first see how many circles can be made from $\frac{6}{4}$ of a circle. How many circles can be made from $\frac{12}{4}$ of a circle? from $\frac{8}{4}$? from $\frac{4}{4}$? Then how many halves of a circle in $\frac{2}{4}$ of the circle? Then $\frac{6}{4}$ of a circle is equal to 1 circle and what part of the circle?

In the same way, $\frac{3}{4}$ yd. $+ \frac{3}{4}$ yd. $= \frac{6}{4}$ yd. $= 1\frac{2}{4}$ yd. $= 1\frac{1}{2}$ yd.

To reduce a fraction to a whole or a mixed number divide the numerator by the denominator.

REDUCING FRACTIONS

Reduce the following to whole or mixed numbers:

1. $\frac{4}{2}$.	5. $\frac{5}{2}$.	9. $\frac{4}{3}$.	13. $\frac{5}{4}$.	17. $\frac{15}{5}$.
2. $\frac{6}{2}$.	6. $\frac{3}{3}$.	10. $\frac{7}{3}$.	14. $\frac{7}{4}$.	18. $\frac{16}{8}$.
3. $\frac{8}{2}$.	7. $\frac{6}{3}$.	11. $\frac{8}{4}$.	15. $\frac{5}{5}$.	19. $\frac{20}{4}$.
4. $\frac{3}{2}$.	8. $\frac{9}{3}$.	12. $\frac{9}{4}$.	16. $\frac{9}{8}$.	20. $\frac{12}{8}$.

Adding Fractions. If Alice buys two remnants of ribbon, one being $5\frac{2}{3}$ yd. long and the other $3\frac{2}{3}$ yd. long, how many yards of ribbon does she buy?

We see that we must add $5\frac{2}{3}$ yd. and $3\frac{2}{3}$ yd.

We first add the thirds, thus:

$$\frac{2}{3} + \frac{2}{3} = \frac{4}{3} = 1\frac{1}{3}.$$

$$\begin{array}{r} 5\frac{2}{3} \\ 3\frac{2}{3} \\ \hline 9\frac{1}{3} \end{array}$$

We write the $\frac{1}{3}$ in fractions' column and add the 1 to units' column. Then $1 + 3 + 5 = 9$, and we write the 9 in units' column.

The sum is $9\frac{1}{3}$, and so Alice buys $9\frac{1}{3}$ yd. of ribbon.

ADDING FRACTIONS

1. If you measure a picture frame and find that it is $10\frac{3}{4}$ in. long and $8\frac{3}{4}$ in. wide, what is the sum of the length and width?

2. In Ex. 1 how many inches of molding are there in the frame?

3. Fanny has three pieces of ribbon. The first is $3\frac{1}{3}$ yd. long, the second $2\frac{1}{3}$ yd. long, and the third $5\frac{2}{3}$ yd. long. How many yards has she in all?

4. Jack wishes to frame a picture and so measures it, finding that the frame must be $10\frac{1}{2}$ in. long and $9\frac{1}{2}$ in. wide. How many inches of molding does he need?

Add the following:

5.	6.	7.	8.	9.	10.
$4\frac{1}{2}$	$3\frac{1}{2}$	$34\frac{1}{3}$	$22\frac{2}{3}$	$25\frac{2}{3}$	$18\frac{1}{3}$
$2\frac{1}{2}$	$2\frac{1}{2}$	$25\frac{1}{3}$	$28\frac{2}{3}$	$13\frac{2}{3}$	$25\frac{2}{3}$
3	$5\frac{1}{2}$	$8\frac{2}{3}$	$7\frac{2}{3}$	$8\frac{2}{3}$	$13\frac{2}{3}$

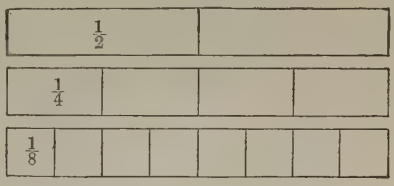
ADDING AND SUBTRACTING FRACTIONS

Numbers 1 to 7, oral

1. Calling the large rectangle *one*, how many halves do you see in 1?

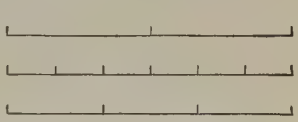
2. How many fourths do you see in 1? in $\frac{1}{2}$?

3. How many eighths do you see in 1? in $\frac{1}{2}$? in $\frac{1}{4}$?



4. How many sixths of this line do you see in $\frac{1}{2}$ of the line?

5. How many sixths in $\frac{1}{3}$? in $\frac{2}{3}$?



6. How many sixths in 1? in $1\frac{1}{2}$? in $1\frac{1}{3}$? in $1\frac{2}{3}$?

7. If Mary has a piece of ribbon $\frac{1}{2}$ yd. long and another piece $\frac{1}{4}$ yd. long, has she enough ribbon for trimming a doll's dress that needs a piece $\frac{3}{4}$ yd. long?

We see by the rectangles above that $\frac{1}{2} = \frac{2}{4}$, and so $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4}$.

But just as $2¢ + 1¢ = 3¢$, so $\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$.

So the sum of $\frac{1}{2}$ and $\frac{1}{4}$ is $\frac{3}{4}$, and Mary has enough trimming for the doll's dress.

$$\frac{1}{2} = \frac{2}{4}$$
$$\frac{1}{4} = \frac{1}{4}$$
$$\frac{3}{4}$$

In such examples we need not consider loss in sewing pieces together.

Looking at the above rectangles and lines, add or subtract as stated:

8. $\frac{1}{2} + \frac{1}{4}$.

9. $\frac{1}{2} - \frac{1}{4}$.

10. $\frac{3}{4} - \frac{1}{2}$.

11. $\frac{3}{4} + \frac{1}{2}$.

12. $\frac{1}{4} + \frac{1}{8}$.

13. $\frac{1}{4} - \frac{1}{8}$.

14. $\frac{3}{4} + \frac{1}{8}$.

15. $\frac{3}{4} - \frac{1}{8}$.

16. $\frac{5}{8} - \frac{1}{4}$.

17. $\frac{7}{8} - \frac{1}{4}$.

18. $\frac{7}{8} - \frac{3}{4}$.

19. $\frac{3}{4} - \frac{5}{8}$.

20. $\frac{1}{2} + \frac{1}{8}$.

21. $\frac{1}{2} - \frac{1}{8}$.

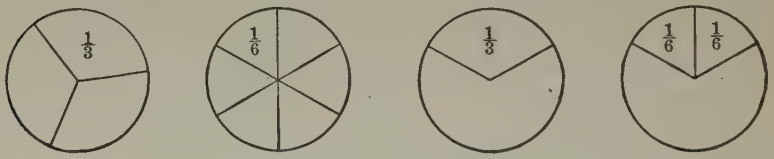
22. $1 - \frac{1}{3}$.

23. $1 - \frac{1}{6}$.

HOW TO ADD FRACTIONS

All work oral

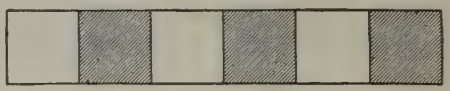
1. If we divide a circle into thirds and cut each third into halves, into how many equal parts is the whole circle divided? What is each of these equal parts called? How many sixths of a circle are there in 1 circle?



2. Kate gave $\frac{1}{6}$ of a pie to Mollie, $\frac{1}{6}$ to Kate, and $\frac{1}{6}$ to Fred. What part of the pie did she give away?

3. Frank's mother gave him $\frac{1}{3}$ of a pie and he gave $\frac{1}{2}$ of his piece to Jack. What part of the pie did Jack receive?

4. Look at $\frac{1}{3}$ of this rectangle and then at $\frac{1}{6}$ of it. You see that $\frac{1}{6}$ is what part of $\frac{1}{3}$? that $\frac{1}{3}$ is how many sixths? that $\frac{1}{2}$ is how many sixths? Then $\frac{1}{2} + \frac{1}{6}$ is how many sixths?



5. How many sixths is $\frac{1}{3} + \frac{1}{6}$? $\frac{1}{2} + \frac{1}{3}$?

6. Suppose that you wish to add $2\frac{1}{2}$ in. and $3\frac{3}{4}$ in. Study this work:

To add $\frac{1}{2}$ to $\frac{3}{4}$ we think of $\frac{1}{2}$ as $\frac{2}{4}$.

We then add the fractions $\frac{2}{4}$ and $\frac{3}{4}$, and obtain as the sum $\frac{5}{4}$, or $1\frac{1}{4}$. Then we add the 1 to the sum of 2 and 3, obtaining 6. Now how much is the sum of $2\frac{1}{2}$ and $3\frac{3}{4}$?

$$2\tfrac{1}{2} = 2\tfrac{2}{4}$$
$$3\tfrac{3}{4} = 3\tfrac{3}{4}$$
$$5\tfrac{5}{4} = 6\tfrac{1}{4}$$

Adding Fractions. If we ask for the sum of 3 boys and 2 girls, the answer cannot be boys alone or girls alone. But we may say,

3 boys = 3 children
2 girls = 2 children
5 children in all

In adding we think of things as having the same name.

In the same way, if we wish to find the sum of $\frac{3}{4}$ and $\frac{1}{2}$, we must think of these as $\frac{3}{4}$ and $\frac{2}{4}$, the sum being $\frac{5}{4}$, or $1\frac{1}{4}$.

In adding fractions we think of them as having the same name.

No problems in this book require any more elaborate treatment of the least common denominator than is given above. The pupil should be able to see the denominator to be used, at least with an occasional hint.

ADDING FRACTIONS

All work oral

1. Express $\frac{1}{2}$ as eighths. To the result add $\frac{3}{8}$.

2. John is making a picture frame. He fastens a strip of molding $\frac{3}{8}$ in. thick to a strip of wood $\frac{1}{2}$ in. thick. How thick are the two together?

3. Express $\frac{3}{4}$ as eighths. To the result add $\frac{7}{8}$.

4. If Ruth sews together insertion $\frac{3}{4}$ in. wide and lace $\frac{7}{8}$ in. wide, how wide are the two together?

5. Express $\frac{1}{2}$ as eighths. To the result add $\frac{7}{8}$.

6. If you lay a notebook $\frac{1}{2}$ in. thick on a book $\frac{7}{8}$ in. thick, how thick are the two together?

ADDING FRACTIONS

1. If we have $3\frac{1}{2}$ yd. of cloth in one piece and $2\frac{1}{4}$ yd. in another, how much have we in both?

2. If we buy $\frac{3}{4}$ yd. of one kind of ribbon and $\frac{3}{8}$ yd. of another kind, how much do we buy in all?

3. If you lay an arithmetic $\frac{5}{8}$ in. thick on a geography $\frac{3}{4}$ in. thick, how thick are the two books together?

4. Kate sews a piece of lace $\frac{1}{16}$ yd. wide to a piece of cloth $\frac{7}{8}$ yd. wide. Express each fraction as 16ths and find the width of the lace and cloth together.

5. If you place a board $\frac{7}{8}$ in. thick on a plank $1\frac{3}{4}$ in. thick, what is the total thickness?

6. If you place a board $1\frac{1}{8}$ in. thick on a beam $9\frac{1}{4}$ in. thick, what is the total thickness?

7. If a desk is $2\frac{3}{4}$ ft. long and $1\frac{3}{8}$ ft. wide, what is the sum of the length and width of the desk?

Add the following:

8. $2\frac{1}{4} + 1\frac{3}{4}$.
9. $4\frac{1}{4} + 2\frac{3}{4}$.
10. $3\frac{1}{2} + 4\frac{1}{8}$.
11. $6\frac{3}{8} + 2\frac{7}{8}$.
12. $5\frac{2}{5} + 6\frac{4}{5}$.
13. $3\frac{1}{2} + 4\frac{3}{8}$.
14. $8\frac{1}{2} + 5\frac{7}{8}$.
15. $4\frac{1}{4} + 3\frac{7}{8}$.
16. $8\frac{3}{4} + 52$.
17. $7\frac{7}{8} + 6\frac{7}{8}$.
18. $5\frac{1}{8} + 6\frac{3}{4}$.
19. $8\frac{3}{8} + 4\frac{5}{8}$.
20. $8\frac{1}{4} + 7\frac{3}{4}$.
21. $9\frac{3}{4} + 9\frac{3}{4}$.
22. $3\frac{1}{2} + 3\frac{1}{6}$.
23. $5\frac{3}{8} + 2\frac{7}{8}$.
24. $4\frac{1}{3} + 3\frac{1}{6}$.
25. $5\frac{2}{3} + 2\frac{5}{6}$.
26. $8\frac{3}{4} + 7\frac{3}{8}$.
27. $5\frac{5}{8} + 3\frac{7}{8}$.
28. $3\frac{7}{8} + 2\frac{5}{8}$.
29. $9\frac{3}{4} + 6\frac{7}{8}$.
30. $4\frac{3}{8} + 6\frac{3}{4}$.
31. $8\frac{1}{4} + 7\frac{1}{3}$.
32. $3\frac{3}{4} + 5\frac{1}{12}$.
33. $4\frac{2}{3} + 1\frac{5}{12}$.
34. $6\frac{3}{4} + 2\frac{7}{12}$.

Subtracting Fractions. Dora has 14 yd. of cloth. She uses $1\frac{2}{3}$ yd. for a doll's suit. How many yards has she left?

We must subtract $1\frac{2}{3}$ yd. from 14 yd.

We cannot take $\frac{2}{3}$ from nothing, so we think of 14 as $13\frac{3}{3}$, which we can do because $\frac{3}{3} = 1$.

We see that $\frac{3}{3} - \frac{2}{3} = \frac{1}{3}$, and we write the $\frac{1}{3}$ in fractions' column. Then $13 - 1 = 12$, and we write the 12 in units' column.

$$\begin{array}{r} 14 \\ 1\frac{2}{3} \\ \hline 12\frac{1}{3} \end{array}$$

The difference is $12\frac{1}{3}$, and so Dora has $12\frac{1}{3}$ yd. left.

SUBTRACTING FRACTIONS

1. Martha has 8 yd. of ribbon. She uses $2\frac{3}{4}$ yd. on a hat. How much ribbon has she left?

2. How many yards in 7 yd. $- 3\frac{1}{8}$ yd.? in 4 yd. $- 2\frac{3}{8}$ yd.?

3. How many feet in 9 ft. $- 3\frac{1}{12}$ ft.? in 7 ft. $- 4\frac{5}{8}$ ft.?

4. If you have a piece of paper 10 in. long, and cut off a piece $2\frac{2}{3}$ in. long, how long is the piece that is left?

5. If Harriet needs $2\frac{3}{4}$ yd. of cloth for some sewing, and has 5 yd., how much has she to spare?

6. If Robert saws a piece of board $10\frac{3}{4}$ in. long from a piece 18 in. long, how long is the piece that is left?

Subtract the following:

7. $\begin{array}{r} 9 \\ 3\frac{1}{2} \\ \hline \end{array}$	**9.** $\begin{array}{r} 8 \\ 3\frac{1}{3} \\ \hline \end{array}$	**11.** $\begin{array}{r} 8\frac{1}{2} \\ 3\frac{1}{2} \\ \hline \end{array}$	**13.** $\begin{array}{r} 6\frac{2}{3} \\ 2\frac{1}{3} \\ \hline \end{array}$	**15.** $\begin{array}{r} 16 \\ 5\frac{1}{4} \\ \hline \end{array}$	**17.** $\begin{array}{r} 17\frac{2}{3} \\ 8\frac{1}{3} \\ \hline \end{array}$
8. $\begin{array}{r} 7 \\ 4\frac{1}{2} \\ \hline \end{array}$	**10.** $\begin{array}{r} 9 \\ 3\frac{2}{3} \\ \hline \end{array}$	**12.** $\begin{array}{r} 7\frac{1}{3} \\ 2\frac{1}{3} \\ \hline \end{array}$	**14.** $\begin{array}{r} 5\frac{2}{3} \\ 3\frac{2}{3} \\ \hline \end{array}$	**16.** $\begin{array}{r} 29 \\ 18\frac{3}{4} \\ \hline \end{array}$	**18.** $\begin{array}{r} 64\frac{2}{3} \\ 36\frac{2}{3} \\ \hline \end{array}$

Further Work in Subtracting Fractions. 1. In making a picture frame John cut a piece of molding $6\frac{3}{8}$ in. long from a piece $9\frac{7}{8}$ in. long. How long was the piece that was left?

We see that $9\frac{7}{8} - 6\frac{3}{8} = 3\frac{4}{8} = 3\frac{1}{2}$.

That is, John has $3\frac{1}{2}$ in. of molding left.

2. How much picture molding will John have left if he takes $4\frac{3}{4}$ in. from $9\frac{1}{2}$ in.?

We must subtract $4\frac{3}{4}$ from $9\frac{1}{2}$.

We see that $\frac{3}{4}$ is greater than $\frac{1}{2}$, and so we cannot take $\frac{3}{4}$ from $\frac{1}{2}$.

We see that $9\frac{1}{2} = 8 + 1\frac{1}{2} = 8\frac{3}{2}$.

We know that $\frac{3}{2} = \frac{6}{4}$.

Instead of $9\frac{1}{2} - 4\frac{3}{4}$ we have $8\frac{6}{4} - 4\frac{3}{4}$.

Since the result is $4\frac{3}{4}$, we see that John has $4\frac{3}{4}$ in. left.

$$9\tfrac{1}{2} = 8\tfrac{3}{2} = 8\tfrac{6}{4}$$
$$4\tfrac{3}{4} = 4\tfrac{3}{4} = 4\tfrac{3}{4}$$
$$4\tfrac{3}{4}$$

SUBTRACTING FRACTIONS

1. If from $2\frac{7}{8}$ yd. we take $1\frac{3}{4}$ yd., how much is left?

2. If from a board $1\frac{5}{16}$ in. thick we plane off $\frac{1}{8}$ in., how thick is the board then?

3. If a notebook is $\frac{9}{16}$ in. thick and the cover is $\frac{1}{8}$ in. thick, how thick is the book without the cover?

4. If from $14\frac{1}{2}$ yd. of cloth Helen cuts $3\frac{3}{4}$ yd., how much cloth has she left?

5. If from $16\frac{1}{2}$ yd. of ribbon May cuts $5\frac{3}{4}$ yd. and $2\frac{1}{2}$ yd., how much ribbon has she left?

6. How much picture molding will Frank have left if he takes $2\frac{7}{8}$ in. from $9\frac{1}{2}$ in.?

WRITTEN REVIEW

Find the following parts of the numbers given:

1. $\frac{1}{3}$ of 156, $\frac{2}{3}$ of 156.
2. $\frac{1}{3}$ of 630, $\frac{2}{3}$ of 630.
3. $\frac{1}{3}$ of 480, $\frac{2}{3}$ of 480.
4. $\frac{1}{5}$ of 325, $\frac{2}{5}$ of 325.
5. $\frac{3}{5}$ of 325, $\frac{4}{5}$ of 325.
6. $\frac{1}{6}$ of 336, $\frac{5}{6}$ of 336.

Add the following:

7. $7\frac{1}{2} + 5\frac{3}{4}$.
8. $8\frac{3}{5} + 6\frac{3}{10}$.
9. $5\frac{1}{4} + 2\frac{3}{8}$.
10. $5\frac{3}{4} + 2\frac{5}{8}$.
11. $9\frac{7}{8} + 6\frac{3}{4}$.
12. $8\frac{2}{3} + 3\frac{5}{6}$.
13. $7\frac{1}{3} + 3\frac{1}{9}$.
14. $7\frac{2}{3} + 3\frac{7}{9}$.
15. $17\frac{3}{5} + 6\frac{9}{10}$.
16. $18\frac{5}{8} + 3\frac{9}{16}$.
17. $14\frac{2}{5} + 3\frac{3}{10}$.
18. $14\frac{4}{5} + 3\frac{7}{10}$.

Subtract the following:

19. $8\frac{2}{3} - 2\frac{1}{3}$.
20. $9\frac{1}{2} - 6\frac{1}{4}$.
21. $7\frac{1}{2} - 3\frac{3}{4}$.
22. $8\frac{1}{2} - 4\frac{7}{12}$.
23. $9\frac{7}{8} - 6\frac{3}{4}$.
24. $7\frac{5}{8} - 3\frac{3}{4}$.
25. $28 - 4\frac{4}{5}$.
26. $35 - 8\frac{11}{12}$.
27. $9\frac{4}{5} - 3\frac{7}{10}$.

28. If from a board $\frac{7}{8}$ in. thick Fred planes off $\frac{1}{16}$ in., how thick is the board then?

29. If Sarah cuts from 15 yd. of cloth $3\frac{1}{2}$ yd. and $2\frac{3}{8}$ yd., how much cloth has she left?

Add the following and also subtract, thus making two examples in each case:

30. $57\frac{2}{3}$ and $39\frac{1}{3}$
32. $89\frac{2}{3}$ and $42\frac{2}{3}$
34. $60\frac{1}{8}$ and $46\frac{1}{2}$
36. $42\frac{7}{8}$ and $29\frac{1}{2}$
38. $56\frac{1}{4}$ and $29\frac{2}{3}$
31. $47\frac{1}{6}$ and $39\frac{2}{3}$
33. $98\frac{1}{4}$ and $69\frac{1}{3}$
35. $20\frac{1}{2}$ and $8\frac{1}{3}$
37. $67\frac{1}{4}$ and $29\frac{2}{3}$
39. $80\frac{3}{4}$ and $68\frac{2}{3}$

A TRIP TO THE CITY

1. Jack's father took him on a trip to the city. They left at half past nine in the morning and arrived at a quarter past eleven. How long were they in going?

2. It is $27\frac{3}{4}$ mi. to the first place where the train stopped, and $38\frac{3}{4}$ mi. from there to the city. How many miles are there in the whole trip to the city?

3. If Jack and his father used a taxi twice, and they rode $3\frac{5}{8}$ mi. the first time and $1\frac{7}{8}$ mi. the other time, how far did they ride both times?

4. They bought, for luncheon on the train coming home, 8 sandwiches at 10¢ each, $\frac{1}{2}$ doz. cookies at 18¢ a dozen, and $\frac{1}{2}$ doz. oranges at 90¢ a dozen. How much did the luncheon cost?

VI. BILLS AND RECEIPTS

Bill of Goods. If you go to the store for some purchases and your parents have an *account* there, the grocer will *charge* the goods purchased, and your parents will pay for them at the end of the month when the grocer sends a *bill*. When the bill is paid he will *receipt* it. This is one of several common forms of a receipted bill:

Atlanta, Ga., June 1, 1922

Mrs. S. J. Williams, 1739 E. Tenth St.

Bought of M. L. BAKEWELL, Grocer
5477 W. Fifteenth Street

May	3	4 tins smoked beef	.35	1	40
	10	7 cans soup	.21	1	47
	17	6 Golden soap	.09		54
				3	41

Received Payment
M. L. BAKEWELL
per J. M.

In this bill three *items* are *entered*. The bill is *filled* by writing the *extensions*, \$1.40, \$1.47, and \$0.54. It is *footed* by adding the extensions, the *amount* of the bill being \$3.41.

The teacher should see that the above technical terms are sufficiently understood and should encourage the pupils to make out bills of goods at prices current in the place where they live. The meaning of the term "debtor" and the abbreviation "Dr." should be explained, although this abbreviation is no longer commonly used on bills.

MAKING OUT BILLS

Copy, fill, foot, and receipt each of the following bills, inserting addresses, dating the bill at the place where you live, receipting it, and signing your name as the clerk:

1.

Mr. James P. Jackson

Bought of GEORGE HALL, Grocer

Feb.	7	3 doz. eggs	.44		
		$6\frac{1}{2}$ lb. butter	.46		
	9	$1\frac{3}{4}$ lb. cheese	.32		
		Received Payment			
		GEORGE HALL			
		per.....			

2.

Mr. M. S. Baldwin

Bought of McFARLANE & CO., Dry Goods

Oct.	5	$1\frac{1}{2}$ yd. silk	2.50		
		2 doz. buttons	.85		
	12	$4\frac{1}{2}$ yd. calico	.22		
		$3\frac{3}{4}$ yd. lace	1.20		
	20	9 yd. linen	1.30		
		$6\frac{3}{4}$ yd. silk	3.00		
		$2\frac{1}{2}$ yd. lace	.90		
		12 yd. ribbon	.40		

Copy, fill, foot, and receipt the following, as on page 227:

3.

[*Name of place, and date*].....19.....

M.....[*Name*].....

Bought of.....[*Name*].....*,* Dealer in Meats and Poultry

.....[*Date*].....	$5\frac{3}{4}$ lb. roast beef	.44		
"	$6\frac{1}{2}$ lb. chicken	.36		
	[*Receipt*].....			

4.

[*Name of place, and date*].....19.....

M.....[*Name*].....

Bought of.....[*Name*].....*,* Grocer

.....[*Date*].....	4 lb. powdered sugar	.14		
"	3 doz. eggs	.45		
"	$\frac{1}{2}$ doz. oranges	.80		
	[*Receipt*].....			

5.

[*Name of place, and date*].....19.....

M.....[*Name*].....

Bought of.....[*Name*].....*,* Grocer

.....[*Date*].....	2 heads lettuce	.12		
"	6 lb. butter	.52		
"	4 gal. oil	.26		
"	8 lb. raisins	.18		
"	3 lb. coffee	.45		
	[*Receipt*].....			

MAKING OUT BILLS

Make out bills for the following:

1. 3 lb. granulated sugar @ 14¢, 4 pk. fancy potatoes @ 65¢, 6 cans salmon @ 18¢.

The symbol @ means "at." If a bill specifies 6 doz. combs @ $2.85, it means that the price is $2.85 a dozen.

2. 8 lb. butterine @ 35¢, 5 jars New Orleans molasses @ 30¢, 3 packages raisins @ 18¢, 6 boxes matches @ 6¢.

3. 34 gro. bone buttons @ 26¢, 438 yd. cambric @ 34¢, 68 doz. pearl buttons @ 18¢, 464 yd. cashmere @ $1.38.

12 dozen = 1 gross (gro.). Therefore 144 = 1 gro.

4. 6 doz. combs @ $2.85, 3 doz. brushes @ $18.37, 4 doz. atomizers @ $26.25, 4 gro. toothbrushes @ $15.35, ½ gro. nailbrushes @ $36.50.

5. 380 yd. matting @ 38¢, 475 yd. matting @ 36¢, 340 yd. carpet @ $1.18, 4 doz. doormats @ $9.75.

6. 16 dining-room sets @ $82.50, 16 rockers @ $9.35, 8 sideboards @ $52.50, 5 china closets @ $37.50.

7. 425 yd. carpet @ $1.18, 620 yd. matting @ 32¢, 28 rugs @ $12.40, 5 rugs @ $16.50, 4 doz. doormats @ $9.30, 426 yd. of calico @ 18¢.

8. 9 doz. hatchets @ $16.75, 7 doz. pairs hinges @ $9.35, 6 doz. carpenter's squares @ $44.50, ½ gro. locks @ $52.50, 9 doz. files @ $9.25.

9. 85 M (85,000) envelopes @ $4.30, 125 lb. paper @ 42¢, 5 doz. fountain pens @ $33.50, 16 doz. bottles ink @ 62¢, 8 dictionaries @ $6.50.

VII. SOLVING PROBLEMS

How to Solve a Problem. We have solved many problems in arithmetic. At first we used only one operation, such as addition or subtraction, in a single problem. Then we came to a time when we used two, and occasionally even more. Before we leave this book we ought to spend a little time in thinking how we solve harder problems.

An automobile dealer bought 7 touring cars at $1450 each and 12 runabouts at $675 each. How much did he pay for them all?

The teacher should now explain that we have first of all to see exactly what is given; then exactly what we wish to find; and finally, how we shall go to work to find it. Most errors in solution come from failing to see clearly the first two of these things. Ask exactly what is first given, the cost of one touring car and the number of cars. What is first required? The cost of 7 touring cars. How shall we go about to find this? Similarly, take up the next two steps, the cost of the runabouts and the total cost of all the cars. Then have the actual computation put down, followed by the statement of the solution. Have the pupils perform the multiplication by 12 by the table of 12's. Explain the abbreviation *Ans.*, and state the desirability of using it. The dollar signs may be omitted in the computation, as a business man would omit them.

1450	675	10150
7	12	8100
10150	8100	18250

The cost of 7 touring cars is $7 \times \$1450$, or $10,150.
The cost of 12 runabouts is $12 \times \$675$, or $8100.
The total cost is $\$10,150 + \$8100$, or $18,250. *Ans.*

SOLVING PROBLEMS

1. A dealer bought 26 typewriters at \$78 each and 2 typewriters at \$65 each. How much did he pay?

2. A dealer bought 18 gas fixtures at \$6.40 each and 16 others at \$4.90 each. How much did he pay?

3. A school bought 64 desks at \$7.75 each and 38 desks at \$6.40 each. How much did it pay?

4. A dealer bought 36 chairs at \$4.80 each and 7 tables at \$12.85 each. How much did he pay?

5. A grocer bought 32 baskets of apples, each basket containing 48 apples, and 16 baskets, each basket containing 36 apples. How many apples did he buy?

6. A dealer bought 24 arithmetics at 42¢ each and 96 notebooks at 18¢ each. How much did he pay?

7. A dealer bought 24 chairs at \$4.75 each and 120 chairs at \$2.96 each. How much did he pay?

8. A dealer bought two large stoves at \$68 each and a small one for \$35. How much did he pay?

9. A grocer buys coffee at 28¢ a pound and sells it for 6¢ a pound more than it cost him. How much does he receive for 18 lb.?

10. A man pays \$80 a month for his apartment and \$36 a month for a cook. How much does he pay in a year for the apartment and the cook?

Teachers should encourage originality of attack in such a problem. Some pupils will take 12 times the sum of \$80 and \$36, while others will find the sum of $12 \times \$80$ and $12 \times \$36$. The two methods may then be compared as to economy of time and effort.

PURCHASES FOR THE BOY SCOUTS

1. These Boy Scouts earned the money for their uniforms. The 5 hats cost \$1.65 each; the coats, \$2.25 each; the trousers, \$2 a pair; the leggings, 85¢ a pair; and the shirts, \$1.60 each. Make out in full a bill for the goods.

2. The patrol leader decided to add to his outfit a belt at 80¢, a canteen at 75¢, and a haversack at \$1.10. He handed the salesman a \$5 bill. What change was due? Make out the bill for the goods.

3. For their hikes they bought a stewpan at 95¢, a water pail at 45¢, a coffeepot at 75¢, and a ring stand at 40¢. How much did they pay for all these? Make out the bill for the goods.

4. For luncheon one day they paid 50¢ for sandwiches, 90¢ for bacon and eggs, and 30¢ for pie, and bought 2 qt. of milk at 10¢ a quart. Each boy paid 20¢ for car fares. How much did the five boys pay in all?

A DAY IN THE CITY

1. Kate's father took her to the city. Their railroad tickets cost \$3.36. They paid 60¢ for street-car fares and \$1.50 for luncheon. They paid 90¢ for a cab to make a call. How much money did they spend?

2. Kate's father gave her the money for some presents. She bought a doll for \$1.25, a pair of roller skates for \$1.75, a bat and a glove to give to her brother Fred for \$1.65, and some handkerchiefs for her mother for \$1.50. How much did she spend in all?

3. Kate bought 3 pairs of gloves at \$1.50 a pair, 2 pairs of shoes at \$3.75 a pair, and 4 yd. of ribbon at 35¢ a yard. How much did she spend for these purchases?

4. Kate's father owed three bills at one place in the city. The amounts were \$125, \$16.50, and \$48.25. She went with him when he paid them. He paid \$200. How much change was due?

5. Kate's father sent a telegram of 18 words. It cost him 40¢ for the first ten words, and 3¢ for each additional word. How much did he pay for telegraphing?

6. Kate did some shopping for her mother. She bought 2 pairs of gloves at \$1.75 a pair, 3 handkerchiefs at 35¢ each, and 2 waists at \$8.75 each. How much did she pay for them all?

7. Kate's father bought for her brother Joe 2 story-books costing 85¢ each, a tennis racket costing \$1.60, a baseball costing 65¢, and a football costing \$2.20. How much did he pay for them all?

MISCELLANEOUS PROBLEMS

1. A class of 24 boys went to an athletic meet. Each boy spent 35¢ for car fare and ticket and 25¢ for lunch. What were the expenses of the whole class?

2. A conductor on a trolley car collected 76 fares on a downtown trip and 58 fares coming back. If each fare is 5¢, how much money did he collect on both trips?

3. Instead of paying 46¢ a pound for butter, Mrs. Cole buys oleomargarine at 29¢ a pound. If the family uses 164 lb. a year, how much money is saved by buying oleomargarine instead of butter?

4. An express train ran 559 mi. in 13 hr. At this rate, how far would it run in 9 hr.?

5. In Ex. 4 how long would it take to run 129 mi.?

6. How many hours would it take an automobile to go 627 mi. at the rate of 19 mi. an hour?

7. Mrs. Roberts has been paying 32¢ a can for soup. She finds that she can get this soup at $3.65 per dozen cans. How much will she save on 36 cans if she buys them by the dozen?

8. If it costs $129 to run a locomotive a single trip between two cities, how much will it cost for nine round trips and a single trip besides?

9. A farmer paid $585 for 9 cows. At this rate, how many cows can he buy with $455?

10. A merchant paid $1494 for 498 yd. of silk. At this rate, how many yards can he buy with $345?

PROBLEMS WITHOUT NUMBERS

1. If you know the cost of each of two different things, how do you find the cost of both together?

2. If you know the number of yards in a piece of cloth and you cut off a part of the cloth, how do you find the length of what is left?

3. If you know the cost of one yard of cloth, how do you find the cost of a given number of yards?

4. If you know the items purchased and the cost per item, how do you make the extensions on a bill?

5. If you know the extensions on a bill, how do you foot the bill?

6. If you know the amount of a bill and know all the extensions but one, which has been blotted out, how do you find the missing extension?

7. If you know the cost of a certain number of yards of cloth, how do you find the cost per yard?

8. If you have a certain number of inches of cloth of a certain width and a book cover requires a certain number of inches of this width, how do you find the number of books you can cover with all the cloth?

9. If you know the number of quarts of cream charged in a monthly bill, how do you find the number of pints?

10. If a bill states the length of a piece of picture molding in feet, how do you find the length in inches?

11. If you know all the items in a bill, how do you find the change due when you give more than the amount?

VIII. MINIMUM ESSENTIALS

WRITTEN EXERCISE

1. Write in figures forty-seven million, fifty-four.
2. Write in words the number 3,142,007.

Add the following numbers:

3.	4.	5.	6.
$287.46	$872.96	$298.38	$2346.85
398.35	29.38	972.49	3972.08
47.63	400.75	635.52	612.45
129.30	23.80	221.08	3648.75
305.75	983.76	39.60	900.01

Subtract, and check the work:

7.	8.	9.	10.
$409.72	$421.30	$900.00	$8073.04
368.96	198.75	43.86	2178.60

11. Multiply $348.75 by 200; by 296.
12. Divide 139,908 by 267; by 200; by 2000.
13. Divide $3110.40 by 144.
14. Express $\frac{3}{4}$ mi. as feet; as yards; as rods.
15. Express $\frac{1}{2}$ A. as square rods.
16. Find the area of a rectangle $12\frac{1}{2}$ ft. by 16 ft.
17. Express 189 cu. ft. as cubic yards.
18. Express 60,000 lb. as tons.
19. From the sum of $12\frac{7}{8}$ and $6\frac{3}{4}$ subtract $3\frac{1}{2}$.

IX. LITTLE EXAMINATIONS

I.
1. $9858 + 7233$.
2. $8906 - 4918$.
3. $\$60.75 + \$40.96$.
4. $\$80.23 - \$42.85$.
5. $38 \times \$2.96$.
6. $300 \times \$16.75$.
7. $62 \times \$48.75$.
8. 575×886.
9. $83{,}984 \div 58$.
10. $1\frac{1}{4}$ cu. ft. = (?) cu. in.

II.
1. $7846 + 6088$.
2. $6709 - 3983$.
3. $\$70.86 + \$92.88$.
4. $\$82.30 - \$49.58$.
5. $98 \times \$32.86$.
6. $400 \times \$17.40$.
7. $38 \times \$124.28$.
8. 385×996.
9. $7625 \div 125$.
10. $1\frac{3}{8}$ cu. ft. = (?) cu. in.

III.
1. $8285 + 7286$.
2. $6133 - 3879$.
3. $\$238.29 + \$38.98$.
4. $\$80.21 - \$38.85$.
5. $79 \times \$8.27$.
6. $620 \times \$9.08$.
7. $368 \times \$52.38$.
8. 695×899.
9. $34{,}500 \div 125$.
10. 288 sq. in. = (?) sq. ft.
11. 19 bu. = (?) pk.
12. $\frac{3}{8}$ of 5436.

IV.
1. $9128 + 6789$.
2. $7230 - 3869$.
3. $\$73.42 + \$89.68$.
4. $\$178.01 - \$96.80$.
5. $86 \times \$9.72$.
6. $870 \times \$9.60$.
7. $349 \times \$872.86$.
8. 3778×5428.
9. $38{,}918 \div 116$.
10. $2\frac{7}{8}$ sq. ft. = (?) sq. in.
11. 68 pt. = (?) qt.
12. $\frac{3}{4}$ of \$432.64.

Teachers should read the note on page 46.

X. WHAT THE PUPIL SHOULD KNOW WHEN HE HAS FINISHED THIS BOOK

YOU SHOULD ADD QUICKLY AND ACCURATELY

Copy and add, timing yourself on each set of ten examples:

1. 8238 + 7285.	**21.** $27.62 + $83.48.
2. 6082 + 3796.	**22.** $624.40 + $78.75.
3. 5382 + 4086.	**23.** 8248 + 9873.
4. 7275 + 3398.	**24.** 2179 + 8283.
5. 3845 + 7762.	**25.** $64.79 + $82.85.
6. 6984 + 4875.	**26.** $719.90 + $828.30.
7. 3235 + 5586.	**27.** $64.62 + $77.94.
8. 8692 + 2173.	**28.** $38.37 + $99.86.
9. 9494 + 7877.	**29.** $85.36 + $49.09.
10. 6036 + 4792.	**30.** $77.49 + $68.97.
11. 5843 + 7386.	**31.** 823 + 496 + 288.
12. 8209 + 2089.	**32.** 429 + 638 + 809.
13. 9778 + 5296.	**33.** 878 + 796 + 605.
14. 3809 + 7986.	**34.** 439 + 383 + 992.
15. 4872 + 2983.	**35.** $8.28 + $6.96 + $5.77.
16. 8849 + 5186.	**36.** $32.80 + $9.96 + $87.40.
17. 3689 + 4098.	**37.** $42.80 + $6.96 + $9.74.
18. 5777 + 7643.	**38.** $723.90 + $84.76 + $58.29.
19. 6283 + 7552.	**39.** $62.80 + $44.76 + $88.27.
20. 3194 + 3385.	**40.** $92.86 + $847.66 + $328.39.

Efficiency tests of this kind are helpful throughout the course, and many of them are provided in this book.

YOU SHOULD SUBTRACT QUICKLY AND ACCURATELY

Copy and subtract the following, timing yourself on each set of ten examples:

1. 8031 – 3299.
2. 7130 – 4896.
3. 8200 – 5838.
4. 6103 – 2986.
5. 8630 – 2986.
6. 5206 – 3889.
7. 6830 – 2965.
8. 8002 – 3983.
9. 5006 – 2098.
10. 8272 – 3968.
11. 6307 – 4835.
12. 8612 – 3834.
13. 7702 – 3686.
14. 5210 – 2087.
15. 6783 – 2838.
16. 4132 – 2988.
17. 8070 – 4842.
18. 6791 – 3998.
19. 9280 – 4699.
20. 7906 – 2986.
21. $240.80 – $57.59.
22. $320.60 – $46.38.
23. $401.50 – $62.38.
24. $380.30 – $49.46.
25. $710.31 – $68.38.
26. $601.02 – $86.74.
27. $526.37 – $309.88.
28. $730.05 – $627.83.
29. $802.23 – $226.48.
30. $723.40 – $338.68.
31. $529.80 – $427.67.
32. $627.75 – $309.08.
33. $907.08 – $521.39.
34. $728.28 – $292.99.
35. $900.60 – $629.36.
36. $702.72 – $378.64.
37. $581.32 – $293.88.
38. $2026 – $373.77.
39. $4000 – $2482.66.
40. $3132.80 – $2966.48.

In computing the time the pupil should include the time of copying. In practical business we have to write the numbers as well as subtract them, and this is part of the training. The pupil should learn to write the numbers neatly and accurately as well as quickly.

YOU SHOULD MULTIPLY QUICKLY AND ACCURATELY

Copy and multiply the following, timing yourself on each set of ten examples:

1. 79×86.	21. 120×440.	41. $9 \times \$88.56$.
2. 32×80.	22. 328×608.	42. $8 \times \$76.89$.
3. 43×76.	23. 738×856.	43. $6 \times \$50.78$.
4. 85×96.	24. 332×587.	44. $8 \times \$46.48$.
5. 32×79.	25. 562×808.	45. $7 \times \$90.75$.
6. 36×88.	26. 377×944.	46. $6 \times \$88.82$.
7. 60×83.	27. 456×876.	47. $9 \times \$98.07$.
8. 70×80.	28. 643×804.	48. $8 \times \$78.84$.
9. 78×96.	29. 729×926.	49. $6 \times \$86.48$.
10. 34×89.	30. 332×586.	50. $7 \times \$90.96$.
11. 34×436.	31. 46×4478.	51. $35 \times \$18.75$.
12. 53×609.	32. 33×7298.	52. $68 \times \$24.46$.
13. 78×896.	33. 31×7777.	53. $26 \times \$38.09$.
14. 82×479.	34. 60×9876.	54. $92 \times \$48.86$.
15. 74×809.	35. 82×7906.	55. $37 \times \$59.76$.
16. 93×789.	36. 38×8460.	56. $56 \times \$41.36$.
17. 67×826.	37. 48×7087.	57. $47 \times \$82.08$.
18. 55×775.	38. 75×8178.	58. $36 \times \$96.08$.
19. 64×858.	39. 46×9476.	59. $38 \times \$59.87$.
20. 93×996.	40. 37×9698.	60. $98 \times \$46.76$.

In giving such efficiency tests the teacher may find it of advantage to give on one day Exs. 1–10 on page 239, Exs. 1–10 on page 240, Exs. 1–10 on page 241, and so on; and on another day Exs. 11–20 on the same pages.

YOU SHOULD DIVIDE QUICKLY AND ACCURATELY

Copy and divide, writing both quotient and remainder, timing yourself on each set of ten examples:

1. $688 \div 13$.	21. $6300 \div 42$.	41. $\$5.76 \div 24$.
2. $618 \div 12$.	22. $6685 \div 45$.	42. $\$2.88 \div 12$.
3. $554 \div 14$.	23. $9030 \div 90$.	43. $\$97.24 \div 4$.
4. $918 \div 45$.	24. $8062 \div 73$.	44. $\$17.28 \div 24$.
5. $957 \div 37$.	25. $4112 \div 91$.	45. $\$17.28 \div 48$.
6. $850 \div 48$.	26. $6984 \div 42$.	46. $\$14.41 \div 11$.
7. $576 \div 34$.	27. $7085 \div 74$.	47. $\$90.09 \div 11$.
8. $894 \div 18$.	28. $2700 \div 68$.	48. $\$26.39 \div 13$.
9. $862 \div 36$.	29. $5008 \div 50$.	49. $\$2886 \div 13$.
10. $588 \div 22$.	30. $8782 \div 56$.	50. $\$9575 \div 25$.
11. $3285 \div 35$.	31. $6400 \div 80$.	51. $\$3270 \div 12$.
12. $6078 \div 56$.	32. $4848 \div 48$.	52. $\$6250 \div 15$.
13. $7710 \div 26$.	33. $6400 \div 40$.	53. $\$8237 \div 32$.
14. $9209 \div 34$.	34. $5400 \div 90$.	54. $\$2238 \div 43$.
15. $8108 \div 43$.	35. $4707 \div 86$.	55. $\$8956 \div 42$.
16. $8807 \div 46$.	36. $3200 \div 76$.	56. $\$4065 \div 45$.
17. $7055 \div 74$.	37. $4801 \div 28$.	57. $\$8005 \div 82$.
18. $9026 \div 92$.	38. $4237 \div 93$.	58. $\$7182 \div 35$.
19. $8071 \div 80$.	39. $6781 \div 89$.	59. $\$9856 \div 28$.
20. $8064 \div 94$.	40. $1900 \div 99$.	60. $\$5792 \div 38$.

In practical work in division there is usually a remainder. When the pupil studies a more advanced book he can carry the quotient as far as may be necessary by means of decimals. At present he should merely indicate the remainder or write a common fraction in the quotient.

YOU SHOULD BE ABLE TO REDUCE, ADD, AND SUBTRACT THE ORDINARY COMMON FRACTIONS OF BUSINESS, AND FIND A FRACTIONAL PART OF A WHOLE NUMBER

Copy the following, and perform the operations indicated, timing yourself on each set of ten examples:

1. $\frac{1}{2} = \frac{}{4}$.
2. $\frac{1}{4} = \frac{}{8}$.
3. $\frac{1}{3} = \frac{}{6}$.
4. $\frac{1}{8} = \frac{}{16}$.
5. $\frac{3}{8} = \frac{}{16}$.
6. $\frac{3}{4} = \frac{}{8}$.
7. $\frac{1}{2} = \frac{}{8}$.
8. $\frac{1}{3} = \frac{}{9}$.
9. $\frac{5}{8} = \frac{}{16}$.
10. $\frac{7}{8} = \frac{}{32}$.
11. $\frac{1}{2} + \frac{3}{8}$.
12. $\frac{3}{4} + \frac{1}{8}$.
13. $\frac{3}{4} + \frac{7}{8}$.
14. $\frac{5}{8} + \frac{1}{2}$.
15. $\frac{7}{8} + \frac{1}{2}$.
16. $\frac{1}{3} + \frac{1}{2}$.
17. $\frac{2}{3} + \frac{1}{2}$.
18. $\frac{2}{3} + \frac{3}{4}$.
19. $\frac{2}{3} + \frac{7}{8}$.
20. $\frac{2}{5} + \frac{1}{3}$.
21. $2\frac{1}{2} - \frac{1}{4}$.
22. $3\frac{3}{4} - \frac{1}{2}$.
23. $2\frac{1}{8} - \frac{1}{2}$.
24. $5\frac{3}{8} - \frac{1}{2}$.
25. $3\frac{5}{8} - \frac{1}{2}$.
26. $5\frac{3}{4} - 2\frac{7}{8}$.
27. $6\frac{3}{5} - 3\frac{1}{2}$.
28. $4\frac{1}{3} - 1\frac{3}{5}$.
29. $8\frac{1}{2} - 3\frac{2}{3}$.
30. $9\frac{3}{4} - 5\frac{2}{3}$.
31. $\frac{1}{2} + \frac{1}{4} + \frac{3}{8}$.
32. $\frac{1}{2} + \frac{3}{4} + \frac{1}{8}$.
33. $\frac{1}{2} + \frac{3}{4} + \frac{5}{8}$.
34. $\frac{1}{2} + \frac{3}{4} + \frac{7}{8}$.
35. $\frac{1}{3} + \frac{1}{4} + \frac{1}{8}$.
36. $\frac{2}{3} + \frac{1}{4} + \frac{3}{8}$.
37. $\frac{2}{3} + \frac{3}{4} + \frac{7}{8}$.
38. $\frac{1}{5} + \frac{1}{2} + \frac{1}{3}$.
39. $\frac{2}{5} + \frac{1}{2} + \frac{1}{3}$.
40. $\frac{4}{5} + \frac{1}{2} + \frac{2}{3}$.
41. $\frac{1}{2}$ of 626.
42. $\frac{1}{3}$ of 528.
43. $\frac{2}{3}$ of 603.
44. $\frac{1}{4}$ of 824.
45. $\frac{3}{4}$ of 556.
46. $\frac{1}{8}$ of 968.
47. $\frac{3}{8}$ of 264.
48. $\frac{5}{8}$ of 496.
49. $\frac{7}{8}$ of 584.
50. $\frac{3}{5}$ of 385.
51. $3\frac{1}{2} + 2\frac{3}{4}$.
52. $4\frac{3}{4} - 3\frac{1}{2}$.
53. $6\frac{3}{8} + 2\frac{1}{2}$.
54. $5\frac{3}{8} - 2\frac{1}{2}$.
55. $8\frac{2}{3} + 3\frac{1}{2}$.
56. $7\frac{2}{3} - 5\frac{1}{2}$.
57. $6\frac{3}{8} + 2\frac{1}{4}$.
58. $9\frac{3}{8} - 7\frac{3}{4}$.
59. $6\frac{2}{3} + 3\frac{1}{4}$.
60. $8\frac{2}{3} - 4\frac{3}{4}$.

THE COMMON TABLES OF MEASURES, AND HOW TO USE THEM

Copy the following, and complete each statement, timing yourself on each set of ten examples:

1. 3 ft. = (?) in.
2. 9 ft. = (?) in.
3. 16 ft. = (?) in.
4. $2\frac{1}{2}$ yd. = (?) in.
5. $8\frac{1}{3}$ yd. = (?) ft.
6. $4\frac{1}{2}$ yd. = (?) ft.
7. $\frac{3}{4}$ yd. = (?) in.
8. $3\frac{1}{2}$ yd. = (?) in.
9. 1 rd. = (?) ft.
10. 2 rd. = (?) ft.
11. 1 rd. = (?) yd.
12. 6 rd. = (?) yd.
13. $1\frac{1}{2}$ mi. = (?) rd.
14. 4 mi. = (?) rd.
15. 1 mi. = (?) yd.
16. $\frac{1}{2}$ mi. = (?) yd.
17. 1 mi. = (?) ft.
18. $2\frac{1}{4}$ mi. = (?) ft.
19. $\frac{2}{3}$ mi. = (?) ft.
20. $\frac{3}{4}$ mi. = (?) ft.
21. 2 lb. = (?) oz.
22. $\frac{1}{4}$ lb. = (?) oz.
23. $2\frac{1}{4}$ lb. = (?) oz.
24. 16 oz. = (?) lb.
25. 144 oz. = (?) lb.
26. 288 oz. = (?) lb.
27. 2 T. = (?) lb.
28. $3\frac{1}{4}$ T. = (?) lb.
29. 7 qt. = (?) pt.
30. $8\frac{1}{2}$ qt. = (?) pt.
31. 3 gal. = (?) qt.
32. $5\frac{3}{4}$ gal. = (?) qt.
33. $6\frac{3}{4}$ gal. = (?) pt.
34. 3 bu. = (?) pk.
35. $5\frac{1}{2}$ bu. = (?) pk.
36. 2 pk. = (?) qt.
37. $3\frac{1}{2}$ pk. = (?) qt.
38. 2 sq. ft. = (?) sq. in.
39. 3 sq. yd. = (?) sq. ft.
40. $9\frac{1}{2}$ hr. = (?) min.

Teachers should remember that we no longer make use of such compound numbers as 4 mi. 17 rd. 3 yd. 2 ft. 2 in.

TABLES FOR REFERENCE

Length

12 inches (in.) = 1 foot (ft.)
3 feet = 36 inches = 1 yard (yd.)
$5\frac{1}{2}$ yards = $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods = 5280 feet = 1 mile (mi.)

Square Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
128 cubic feet = 1 cord (cd.)

Weight

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

Liquid Measure

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

Dry Measure

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

Multiplication Table

$1\times2=2$	$1\times3=3$	$1\times4=4$	$1\times5=5$
$2\times2=4$	$2\times3=6$	$2\times4=8$	$2\times5=10$
$3\times2=6$	$3\times3=9$	$3\times4=12$	$3\times5=15$
$4\times2=8$	$4\times3=12$	$4\times4=16$	$4\times5=20$
$5\times2=10$	$5\times3=15$	$5\times4=20$	$5\times5=25$
$6\times2=12$	$6\times3=18$	$6\times4=24$	$6\times5=30$
$7\times2=14$	$7\times3=21$	$7\times4=28$	$7\times5=35$
$8\times2=16$	$8\times3=24$	$8\times4=32$	$8\times5=40$
$9\times2=18$	$9\times3=27$	$9\times4=36$	$9\times5=45$
$10\times2=20$	$10\times3=30$	$10\times4=40$	$10\times5=50$
$11\times2=22$	$11\times3=33$	$11\times4=44$	$11\times5=55$
$12\times2=24$	$12\times3=36$	$12\times4=48$	$12\times5=60$

$1\times6=6$	$1\times7=7$	$1\times8=8$	$1\times9=9$
$2\times6=12$	$2\times7=14$	$2\times8=16$	$2\times9=18$
$3\times6=18$	$3\times7=21$	$3\times8=24$	$3\times9=27$
$4\times6=24$	$4\times7=28$	$4\times8=32$	$4\times9=36$
$5\times6=30$	$5\times7=35$	$5\times8=40$	$5\times9=45$
$6\times6=36$	$6\times7=42$	$6\times8=48$	$6\times9=54$
$7\times6=42$	$7\times7=49$	$7\times8=56$	$7\times9=63$
$8\times6=48$	$8\times7=56$	$8\times8=64$	$8\times9=72$
$9\times6=54$	$9\times7=63$	$9\times8=72$	$9\times9=81$
$10\times6=60$	$10\times7=70$	$10\times8=80$	$10\times9=90$
$11\times6=66$	$11\times7=77$	$11\times8=88$	$11\times9=99$
$12\times6=72$	$12\times7=84$	$12\times8=96$	$12\times9=108$

SUGGESTIONS TO TEACHERS

When the pupil begins a new book the teacher should always give a thorough review of the preceding work. Such a review is provided in part in Chapter I of this book, but no textbook should be expected to supply all the oral drill that is necessary for the pupils. During the summer vacation it is natural for a child to forget the number relations which he has learned but has not been using, and the teacher of the preceding year should not be held responsible for this psychological fact.

Teachers should always understand that the most real problems are those which occur in the child's actual life at home, at play, and in the school. This is particularly true of problems involving cost and measurements of lengths. Simple one-step problems should therefore be introduced, derived from the experience of the children. In these problems the numbers should be smaller than they are in the abstract work, for the reason that the concrete conditions, if real to the child, can hardly involve numbers of more than two or three figures in the primary grades. It is proper to use larger numbers in problems designed to show the need for computing with such numbers, but it is better not to give them in problems intended to illustrate the home life of the children.

With respect to the large amount of drill work which any usable textbook must contain, the teacher should feel free to omit such portions as are not found to be necessary in any particular class. When the pupils have mastered an operation and can handle the work easily and compute accurately and with fair rapidity they should pass on to the next topic. In all such work aim first to secure accuracy; this is far more important than speed. The children should constantly have it impressed upon them that absolute accuracy is demanded in all parts of arithmetic.

In performing the various operations it should be remembered that the great aim is mechanical efficiency. At the same time the child's interest in the work is increased if the operation is presented in such a manner that the reason for the various steps is understood for the time being. Thus, in multiplying 326 by 12 the teacher may find it advantageous to develop the work on the lines here suggested, using first the plan marked (1) and then erasing the unnecessary figures and showing the pupils that the plan marked (2) is all they need to use.

(1)		(2)
326		326
12	$= 10 + 2$	12
652	$= 2 \times 326$	652
3260	$= 10 \times 326$	326
3912	$= 12 \times 326$	3912

Similarly, in presenting the case of $522 \div 6$ the teacher may find it helpful to separate the dividend as here shown, thereafter using the common form given in the book.

$$6)\underline{522}$$

$$6)\underline{480 + 42}$$

$$80 + 7 = 87$$

In the teaching of subtraction it should be remembered that there are several methods actually used in business. For example, in the case of $47 - 28$, we may think of the numbers as follows:

$47 = 40 + 7$	or	$30 + 17$
$28 =$		$\underline{20 + 8}$
Subtracting, we have		$10 + 9 = 19$

This subtraction may be performed either directly, by taking 8 from 17, and 20 from 30; or indirectly, by thinking "8 and 9 are 17, 2 and 1 are 3."

We may also think of both numbers as increased by 10.

Instead of 47 we shall have	$40 + 17$
Instead of 28 we shall have	$\underline{30 + 8}$
Subtracting as before, we have	$10 + 9 = 19$

Any one of these plans is allowable, and the school should decide upon the one to be employed.

INDEX

	PAGE
Account	227
Addend	51
Addition, 5, 17, 23, 51, 101, 139, 187, 212, 218	
terms used	51
Area	127, 197, 201
Average	123, 155, 156
Bill	227
Cancellation	214, 216
Change, making	108
Check in addition	23
in division	120, 163, 193
in subtraction	57, 105
Combinations, fundamental	20
Counting	1, 13, 47, 97, 135
Cube	202
Cubic measure	202
Denominator	209
Difference	9, 57
Dimensions	202
Dividend	66, 120
Division	66, 119, 153, 190
terms used	66, 120
Divisor	66, 120
Dozen	40
Dramatized occupations, 2, 3, 5, 6, 7, 10, 17, 43, 92	
Drawing exercises, 128, 129, 155, 199	
Dry measure	85
Equality, sign of	5
Exact division	124
Fourths	37, 131
Fraction, terms of a	209
Fractions	34, 87, 130, 177, 209
Fundamental combinations	20
Games	8, 10, 11, 17, 22, 24, 25, 111
Half	34
Improper fraction	209
Integer	209
Length	31, 169, 195
Liquid measure	41, 86, 170
Little Examinations, 46, 96, 134, 184, 238	
Long division	157, 159, 193
Lowest terms	213
Making change	108
Measures	31, 85, 125, 169, 195
Million	186
Minimum Essentials, 45, 95, 133, 183, 237	
Minuend	57
Minus sign	9
Mixed number	209
Money	14, 100
Multiplicand	63, 109

PAGE

Multiplication . 63, 109, 149, 189, 211
terms used 63, 109
Multiplier 63, 109

Numerator 209

Occupation problems, 18, 93, 102, 104, 175, 233
Ordinal numbers 16

Perimeter 129
Plus sign 5
Problem solving 231
Problems without numbers, 44, 94, 132, 182, 236
Product 63, 109
Proper fraction 209
Purchasing articles, 30, 91, 104, 113, 114, 115, 126, 142, 143, 146, 178, 181, 211, 234

Quotient 66, 120

Reading and writing numbers, 13, 15, 48, 97, 135, 185
Receipt 227
Rectangle 36, 137
Reduction of fractions . . 213, 217
Remainder 124
Roman numerals . . . 50, 99, 138

PAGE

Scale, drawing to 128, 199
Sixths 90
Solid 202
Solving problems 231
Square measure 127, 197
Store problems, 30, 91, 104, 113, 114, 115, 126, 142, 143, 146, 178, 181, 211, 234
Subtraction . . 9, 27, 57, 105, 145, 188, 212, 219, 223
special methods of 248
terms used 57
Subtrahend 57
Suggestions to Teachers 247
Sum 5, 51

Tables, 14, 19, 31, 41, 50, 85, 86, 125, 127, 245
Temperature 206
Terms of a fraction 209
Thirds 87
Thousand 97
Time 50, 172

Unit of measure 198

Volume 202

Weight 42, 125, 205
Wood measure 204

ANSWERS

Page 4. **1.** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. **2.** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1. **3.** 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0. **6.** 10. **7.** 10. **8.** 10. **11.** 4, 10, 6, 8, 2, 9. **12.** 6, 5, 8, 4, 2, 9. **13.** 10.

Page 9. **6.** 6; 1; 2; 7; 0; 6; 7; 5. **7.** 5; 8; 4; 4; 2; 2; 7; 6.

Page 10. **6.** 3; 7; 1; 1; 6; 6; 9; 7. **7.** 8; 3; 0; 6; 3; 4; 2; 3.

Page 12. **1.** 2; 2; 2; 8; 0; 2; 2; 8. **2.** 1; 3; 0; 1; 3; 3; 4; 6. **3.** 0; 5; 2; 4; 0; 4; 8; 4. **4.** 5; 3; 5; 5; 2; 6; 9; 2. **5.** 4; 1; 5; 3; 12; 2; 0; 1. **6.** 4; 11; 3; 6; 12; 7; 12; 3. **7.** 5. **8.** 5. **9.** 10. **10.** 7. **11.** 5. **12.** 5.

Page 15. **7.** 15. **8.** 12. **9.** 60. **10.** 16. **11.** 8. **12.** 80. **13.** 18. **14.** 11. **15.** 90. **16.** 19. **17.** 70. **18.** 17.

Page 16. **9.** 31. **10.** 52. **11.** 66. **12.** Thirty-three. **13.** Forty-nine. **14.** Ninety-four. **15.** Nineteen. **16.** Ninety. **17.** 19. **18.** 38. **19.** 54. **20.** 69. **21.** 99.

Page 17. **6.** 9; 10; 11; 12; 10; 11; 12; 13. **7.** 11; 12; 13; 14; 13; 14; 15; 15. **8.** 6; 9; 14; 8; 14; 11; 12; 10.

Page 18. **6.** $79. **7.** 8. **8.** 18. **9.** 8. **10.** 18. **11.** 8. **12.** 18. **13.** 9. **14.** 19. **15.** 9. **16.** 19. **17.** 9. **18.** 19. **19.** 10. **20.** 20. **21.** 10. **22.** 20. **23.** 19. **24.** 19. **25.** 30. **26.** 40. **27.** 59. **28.** 56. **29.** 68. **30.** 79.

Page 23. **16.** 13. **17.** 17. **18.** 16. **19.** 17. **20.** 19. **21.** 14.

Page 26. **1.** 35. **2.** 78. **3.** 47. **4.** 77. **5.** 70. **6.** 79. **7.** 86. **8.** 88. **9.** 97. **10.** 99. **11.** 98. **12.** 99. **13.** 99. **14.** 67. **15.** 97. **16.** 59.

Page 28. **1.** 15. **2.** 10. **3.** 13. **4.** 15. **5.** 50. **6.** 56. **7.** 54. **8.** 22. **9.** 51. **10.** 72. **11.** 42. **12.** 62. **13.** 58. **14.** 39. **15.** 34. **16.** 53. **17.** 53. **18.** 54. **19.** 24. **20.** 44. **21.** 63. **22.** 23. **23.** 20. **24.** 90. **25.** 42. **26.** 41. **27.** 44. **28.** 54. **29.** 44. **30.** 0. **31.** 15. **32.** 35. **33.** 30. **34.** 55. **35.** 44. **36.** 23. **37.** 67. **38.** 57. **39.** 31. **40.** 71. **41.** 54. **42.** 52. **43.** 45. **44.** 26. **45.** 52.

Page 30. **1.** 35¢. **2.** 45¢. **3.** 50¢. **4.** 28. **5.** 40¢. **6.** 10¢. **7.** 13¢. **8.** 10¢.

Page 32. **2.** 3. **3.** 6. **4.** 12. **5.** 36. **6.** 4. **8.** 6. **9.** 9. **10.** 5. **11.** 7. **12.** 24. **13.** 36. **14.** 14. **15.** 28.

Page 33. **3.** 12. **4.** 25. **5.** 9; 15. **6.** 8; 16. **13.** 7. **14.** 4.

Page 34. **1.** 2. **3.** $\frac{1}{2}$ in. **7.** 1. **9.** 2. **15.** 2. **16.** 2. **17.** 3. **18.** 4. **19.** 5.

Page 35. **1.** 12; 6. **2.** 3. **3.** 3. **4.** 4. **5.** 4. **6.** 5. **7.** 6. **8.** 8. **9.** 10. **10.** 10. **11.** 12.

Page 36. **4.** 4 years. **5.** 5 ft. **6.** $\frac{1}{2}$. **7.** $\frac{1}{2}$.

Page 37. **1.** 4. **4.** $\frac{1}{2}$. **5.** 2. **9.** 1. **10.** 4. **11.** 36; 36. **12.** 9.

Page 38. **1.** 1. **2.** 1. **3.** 1. **4.** 2. **5.** 6. **6.** 2. **7.** 2. **11.** 12. **12.** $\frac{1}{4}$. **13.** 25; 50.

Page 39. **15.** 6¢. **16.** 5 years. **17.** 3 ft. **18.** 3. **19.** 6.

Page 40. **8.** 6. **9.** 12. **10.** $\frac{1}{2}$. **11.** 3. **12.** 12. **13.** $\frac{1}{4}$. **14.** 9. **15.** 12. **16.** $\frac{3}{4}$.

Page 43. **5.** 24. **6.** 18. **7.** 15.

Page 45. **1.** 78; 80; 90. **2.** Zero, or naught; thirty; twenty-two; eighty-four; sixty; ninety-eight. **3.** 30. **4.** 8. **5.** 2. **6.** 21. **7.** 39. **8.** 59. **9.** 58. **10.** 88. **11.** 77. **12.** 39. **13.** 36. **14.** 30. **15.** 8. **16.** 20. **17.** 52. **18.** 16. **19.** 21. **20.** 11. **21.** 12. **22.** 15. **23.** 13. **24.** 7. **25.** 27. **26.** 3; 5.

Page 46. I. **1.** 12. **2.** 9. **3.** 28. **4.** 15. **5.** 4. **6.** 3. **7.** 2¢. **8.** 3¢. **9.** 1. **10.** 3. **11.** 18. **12.** 35. II. **1.** 13. **2.** 8. **3.** 52. **4.** 31. **5.** 4 ft. **6.** 2 ft. **7.** 3 in. **8.** 6 in. **9.** 2. **10.** 12. **11.** 30. **12.** 68. III. **1.** 49. **2.** 7. **3.** 65. **4.** 53. **5.** 5¢. **6.** 2 in. **7.** 3 lb. **8.** 3 qt. **9.** $\frac{1}{2}$. **10.** 6. **11.** 15. **12.** 92. IV. **1.** 79. **2.** 8. **3.** 58. **4.** 44. **5.** 5. **6.** $5. **7.** 3¢. **8.** $3. **9.** 3. **10.** 24. **11.** 27. **12.** 53. V. **1.** 89. **2.** 7. **3.** 87. **4.** 47. **5.** 10. **6.** 7. **7.** 6 lb. **8.** 4. **9.** 4. **10.** 2. **11.** 9. **12.** 73.

Page 47. **1.** 40. **2.** 50. **3.** 300; 700. **4.** 10. **5.** 10; 10; one hundred; one thousand.

Page 48. **6.** 666. **7.** 341. **8.** 569. **9.** 409. **10.** 703. **11.** 808. **12.** One hundred seventy-five. **13.** Four hundred eighty-three. **14.** Seven hundred. **15.** Eight hundred ninety-six. **16.** Nine hundred eighty.

Page 49. **5.** 102. **6.** 204. **7.** 309. **8.** 403. **9.** 607. **10.** 116. **11.** 160. **12.** 490. **13.** 640. **14.** 818. **15.** Three hundred twenty-eight. **16.** Eight hundred eight. **17.** Eight hundred thirty-four. **18.** Six hundred eight. **19.** Nine hundred seventy-eight. **20.** Eight hundred. **21.** Eight hundred forty-two. **22.** Six hundred thirty. **23.** Five hundred eight. **24.** One thousand. **25.** 63. **26.** 32. **27.** 58. **28.** 98. **29.** 400. **30.** 900. **31.** 678. **32.** 882. **33.** 491. **34.** 278. **35.** 362. **36.** 921.

Page 52. **1.** 27. **2.** 40; 4. **3.** 52. **4.** 60 ft. **5.** 72.

Page 53. **1.** 56. **2.** 70. **3.** 70. **4.** 60. **5.** 64. **6.** 76. **7.** 64. **8.** 76. **9.** 40. **10.** 73. **11.** 60. **12.** 91. **13.** 73. **14.** 95. **15.** 92. **16.** 81. **17.** 81. **18.** 54.

19. 92. **20.** 82. **21.** 72. **22.** 83. **23.** 68. **24.** 90. **25.** 60. **26.** 64. **27.** 90. **28.** 73. **29.** 85. **30.** 111. **31.** 71. **32.** 80. **33.** 82. **34.** 54. **35.** 65. **36.** 80. **37.** 83. **38.** 91. **39.** 58. **40.** 85. **41.** 90. **42.** 62. **43.** 45. **44.** 51. **45.** 94. **46.** 64. **47.** 73. **48.** 81. **49.** 78. **50.** 91. **51.** 80. **52.** 64. **53.** 91. **54.** 85. **55.** 63. **56.** 65. **57.** 76. **58.** 63. **59.** 83. **60.** 76.

Page **54.** **1.** 260. **2.** 281. **3.** 572 ft. **4.** 584. **5.** 777. **6.** 773. **7.** 761. **8.** 712. **9.** $753.

Page **55.** **1.** 418. **2.** 309 miles. **3.** 606. **4.** 827. **5.** 646. **6.** 666. **7.** 850. **8.** $635.

Page **56.** **1.** 524. **2.** 757. **3.** 741. **4.** 916. **5.** 481. **6.** 731. **7.** 811. **8.** 620. **9.** 911. **10.** 831. **11.** 813. **12.** 897. **13.** 632.

Page **57.** **1.** 12. **2.** 8 ft. **3.** 8. **4.** 6 in.

Page **58.** **1.** 34. **2.** 18. **3.** 28. **4.** 28. **5.** 42. **6.** 19. **7.** 28. **8.** 35. **9.** 37. **10.** 43. **11.** 37. **12.** 46. **13.** 54. **14.** 58. **15.** 44. **16.** 28. **17.** 39. **18.** 28. **19.** 39. **20.** 23. **21.** 47. **22.** 48. **23.** 27. **24.** 27. **25.** 28. **26.** 44. **27.** 53. **28.** 24. **29.** 43. **30.** 63. **31.** 28. **32.** 16. **33.** 14¢. **34.** 6. **35.** 17.

Page **59.** **1.** 482. **2.** 292. **3.** 272. **4.** 473. **5.** 451. **6.** 242. **7.** 464. **8.** 282. **9.** 252. **10.** 482. **11.** 492. **12.** 493. **13.** 412. **14.** 363. **15.** 185.

Page **61.** **1.** 528. **2.** 318. **3.** 219. **4.** 566. **5.** 474. **6.** 289. **7.** 636. **8.** 475. **9.** 360. **10.** 27. **11.** 438. **12.** 387. **13.** 225. **14.** 366. **15.** 248. **16.** 334. **17.** 488. **18.** 485. **19.** 509. **20.** 374. **21.** 335. **22.** 512. **23.** 468. **24.** 335. **25.** 296. **26.** 517. **27.** 359. **28.** 188. **29.** 96. **30.** 694. **31.** 177. **32.** 408. **33.** 532. **34.** 547. **35.** 482. **36.** 136. **37.** 455. **38.** 135 ft.

Page **62.** **1.** 217. **2.** 206. **3.** 230. **4.** 341. **5.** 462. **6.** 246. **7.** 457. **8.** 569. **9.** 433. **10.** 621. **11.** 338. **12.** 453. **13.** 364. **14.** 435. **15.** 644. **16.** 288. **17.** 165. **18.** 79. **19.** 686. **20.** 563. **21.** 465. **22.** 147. **23.** 324. **24.** 436. **25.** 237. **26.** 297. **27.** 388. **28.** 377. **29.** 291. **30.** 276.

Page **65.** **21.** 4; 8; 8; 12; 16; 18; 3; 18; 0; 0. **22.** 6; 6; 10; 10; 14; 12; 2; 2; 14; 24. **23.** 1; 0; 0; 7; 0; 9; 9; 0; 0; 22.

Page **67.** **8.** 3. **9.** 3. **10.** 4. **11.** 5. **12.** 6. **13.** 21.

Page **68.** **13.** 3. **14.** 3. **15.** 3. **16.** 3. **17.** 3. **18.** 3. **19.** 3. **20.** 11. **21.** 0. **22.** 8. **23.** 6. **24.** 12. **25.** $21. **26.** $36; $33. **27.** $27; $33; $24; $21.

Page **69.** **8.** 8. **9.** 4; 6; 7; 9; 12. **10.** 7; 7. **11.** 4; 2. **12.** 27. **13.** 21. **14.** 18. **15.** 15. **16.** 24. **17.** 12.

Page **70.** **10.** 3. **11.** 2. **12.** 3. **13.** 2. **14.** 3. **15.** 2. **16.** 12. **17.** 24. **18.** $\frac{1}{3}$.

Page **72.** **13.** 36; 44. **14.** 48. **15.** 24; 20; 44. **16.** 48.

Page **73.** **10.** 6. **11.** 8. **12.** 4. **13.** 4. **14.** 10. **15.** 48.

Page 74. **9.** 22. **10.** 52. **11.** 33. **12.** 29.

Page 75. **6.** 5. **7.** 5. **8.** 20. **9.** 45. **10.** 15. **11.** 8. **12.** 9; 7; 5; 12. **13.** 7; 9; 3; 10; 12. **14.** 8; 10; 4; 6; **11.** **15.** 8.

Page 77. **6.** 12; 18. **7.** 4; 5; 11; 2; 6; 12. **8.** 8; 9; 10; 6; 12; 11. **9.** 9; 6; 7; 12; 5; 4; 2; 8; 10.

Page 79. **6.** 9. **7.** 6. **8.** 12¢. **9.** 12¢. **10.** $11.

Page 81. **10.** 6; 9; 7; 11; 12. **11.** 8; 9; 2; 4. **12.** 4. **13.** 3. **14.** 12. **15.** 88. **16.** 7. **17.** 8. **18.** 6. **19.** 96. **20.** 9. **21.** 8. **22.** 88.

Page 82. **7.** 9; 18; 27; 36; 45; 54; 63; 72; 81; 90; 99; 108. **8.** $63; $81; $108. **9.** $96. **10.** 126¢.

Page 83. **8.** 59. **9.** 66. **10.** 88. **11.** 48. **12.** 8. **13.** 108. **14.** 99¢.

Page 87. **12.** 2. **13.** 3. **14.** 6. **15.** 4.

Page 90. **7.** $\frac{1}{2}$. **8.** $\frac{1}{3}$. **9.** $\frac{2}{3}$. **10.** $\frac{2}{4}$; $\frac{1}{2}$.

Page 91. **1.** 21¢. **2.** 16¢. **3.** 17¢. **4.** 43¢. **5.** 23¢. **6.** 14¢; 11¢.

Page 92. **1.** 15¢. **2.** 96¢. **3.** 96¢. **4.** 63¢. **5.** 12. **6.** 4. **7.** 8. **8.** 12.

Page 93. **1.** 96. **2.** 24. **3.** $24. **4.** 60¢. **5.** 150.

Page 95. **1.** 470. **2.** Five hundred nine; five hundred ninety; nine hundred fifty; nine hundred five. **3.** 675. **4.** 641. **5.** 961. **6.** 759. **7.** 1027. **8.** 485. **9.** 657. **10.** 803. **11.** 524. **12.** 776. **13.** 455. **14.** 457. **15.** 498. **16.** 258. **17.** 244. **18.** 504. **19.** 485. **20.** 272. **21.** 487. **22.** 491. **23.** 42. **24.** 56. **25.** 72. **26.** 63. **27.** 54. **28.** 64. **29.** 81. **30.** 12. **31.** 5. **32.** 5. **33.** 6. **34.** 9. **35.** 9. **36.** 9. **37.** 47. **38.** 20. **39.** 19. **40.** 17. **41.** 11. **42.** 11. **43.** 26.

Page 96. I. **1.** 57. **2.** 36. **3.** 11. **4.** 44. **5.** 4. **6.** 36. **7.** 77. **8.** 12. **9.** 12. **10.** 9. **11.** 10. **12.** 4. II. **1.** ~~122.~~ **2.** 38. **3.** 9. **4.** 62. **5.** 8. **6.** 6. **7.** 88. **8.** 96. **9.** 12. **10.** 8. **11.** 8. **12.** 36. III. **1.** 164. **2.** 17. **3.** 8. **4.** 39. **5.** 9. **6.** 10. **7.** 44. **8.** 48. **9.** 10. **10.** 10. **11.** 7. **12.** 6. IV. **1.** 610. **2.** 177. **3.** 7. **4.** 88. **5.** 8. **6.** 9. **7.** 55. **8.** 96. **9.** 6. **10.** 3. **11.** 6. **12.** 2. V. **1.** 874. **2.** 108. **3.** 120. **4.** 110. **5.** 4. **6.** 12. **7.** 6. **8.** 108. **9.** 4. **10.** 2. **11.** 3. **12.** 36.

Page 98. **41.** 101; 202. **42.** 1001; 10,000. **43.** 2202. **44.** 3516. **45.** 3619. **46.** 4868. **47.** 5959. **48.** 6789. **49.** 8888. **50.** 9919. **51.** 9999.

Page 99. **6.** XVI; XVIII; VII; XII; XIX; IV, or IIII; IX; V; X. **7.** 8; 12; 19; 14; 16; 7; 17.

Page 100. **13.** $5. **14.** $36. **15.** $85. **16.** $1.50. **17.** $35.09. **18.** $208.25.

Page 101. **1.** 375. **2.** 327. **3.** 441. **4.** 481. **5.** 400. **6.** $390.

Page 102. **1.** 360. **2.** 427. **3.** 805. **4.** 503. **5.** $489. **6.** $124.

Page 103. **1.** $8.80. **2.** $6.35. **3.** $13.15. **4.** $8.55. **5.** $11.20. **6.** $10.75. **7.** $9.95. **8.** $12.28. **9.** $17.70. **10.** $9.33.

Page 104. 1. $7.44. 2. $11.13. 3. $7.01. 4. $8.30. 5. $8.71. 6. $9.31. 7. $7.47. 8. $6.81. 9. $7.42. 10. $9.74. 11. $7.11. 12. $6.95.

Page 106. 1. $2.95. 2. $1.65. 3. $235.65. 4. $84.05. 5. $50.89. 6. $60.76. 7. $21.65. 8. $33.02. 9. $26.85. 10. $49.59. 11. $75.52. 12. $3.85. 13. $47.62. 14. $15.29. 15. $8.72. 16. $58.39. 17. $43.31. 18. $66.37. 19. $33.84. 20. $42.57. 21. $0.91. 22. $53.72. 23. $18.78. 24. $26.22. 25. $40.25. 26. $49.77. 27. $83.27. 28. $83.35.

Page 107. 1. 7000. 2. 2284. 3. 6404. 4. 592. 5. 2539. 6. 3139. 7. 1689. 8. 3163. 9. 4537. 10. 3595. 11. 3407. 12. 1334. 13. 1331. 14. 124. 15. 35. 16. 3547. 17. 5691. 18. 2122. 19. 3322. 20. 2789. 21. 3683. 22. 3391. 23. 3992. 24. 46. 25. 1628.

Page 109. 1. 48. 2. 63. 3. 26. 4. 60. 5. 62. 6. 63. 7. 64. 8. 88. 9. 86. 10. 55. 11. 88. 12. 66. 13. 84. 14. 69.

Page 110. 1. $84. 2. $168. 3. 75¢. 4. $128; $144. 5. 176. 6. 272. 7. 220. 8. 154. 9. 132. 10. 296. 11. 220. 12. 434. 13. 238. 14. 165. 15. 195. 16. 608. 17. 78. 18. 485. 19. 592. 20. 774. 21. 215. 22. 480. 23. 342. 24. 756. 25. 96. 26. 224. 27. 656. 28. 248.

Page 111. 1. 78. 2. 108. 3. 114. 4. 92. 5. 24; 120. 6. 119.

Page 113. 1. $7.50. 2. $29.25. 3. $28.80. 4. $4.76. 5. $2.25. 6. $43.20. 7. $13. 8. $45.50. 9. $38.10. 11. $51.66. 12. $41.75. 13. $156.72. 14. $122.70. 15. $358.74. 16. $398.80. 17. $478. 18. $596.96.

Page 115. 1. $5; $5.60; $6.20. 2. $4.50; $4.80; $5.30. 3. $1; $1.60. 4. 60¢. 5. $3.50; $1.40. 6. $12.50; $25; $37.50. 7. $167.50; $502.50. 8. $682.50; $2047.50; $3412.50. 9. $825; $2475; $4950. 10. $855; $1710; $4275. 11. $377.50; $755; $1510. 12. $1350; $2700.

Page 116. 1. 392. 2. 624. 3. 912. 4. 1728. 5. 1862. 6. 1701. 7. 3990. 8. 2759.

Page 117. 1. $768. 2. $1248; $720. 3. $256; $400; $608. 4. $102.75. 5. $145.62. 6. $134.96. 7. $73.91. 8. $56.44. 9. $49.06. 10. $108.46. 11. $250.38. 12. $220.40. 13. $471.20. 14. $264.32. 15. $478.08. 16. $410.62. 17. $285. 18. $49.14. 19. $368.08. 20. $245.52. 21. $281.30. 22. $414. 23. $10.73. 24. $468.

Page 118. 1. $73.50. 2. $158.40. 3. $507. 4. $303.75. 5. $102.96. 6. $278.88. 7. $234.58. 8. $362.11. 9. $191.40. 10. $244.30. 11. $419.25. 12. $967.26. 13. $1215. 14. $2003.40. 15. $5459.10. 16. $5235.70. 17. $753.60. 18. $1888.50. 19. $8999.10. 20. $3159. 21. $1520. 22. $9693. 23. $5390.05. 24. $6142.08. 25. $4909.20. 26. $7182.95. 27. $8921.56. 28. $7342.64. 29. $8934.52. 30. $8605.48. 31. $4024. 32. $6577.20. 33. $9007.20. 34. $12,729.

Page 120. **4.** 22. **5.** 21. **6.** 13. **7.** 22. **8.** 12. **9.** 11. **10.** 10. **11.** 11.

Page 121. **1.** 23. **2.** 12; 13; 15; 16. **3.** 14; 16; 17; 19. **4.** 15; 18; 27; 28; 36; 37; 39; 49. **5.** 8; 14; 19; 17; 16; 27; 28; 29. **6.** 13; 17; 16; 23; 24; 14; 15; 19. **7.** 13. **8.** 14. **9.** 12. **10.** 12.

Page 122. **1.** 123. **2.** 101. **3.** 434; 4342; 4343. **4.** 111. **5.** 110. **6.** 101. **7.** 123. **8.** 132. **9.** 130. **10.** 103. **11.** 100. **12.** 120. **13.** 102. **14.** 1212. **15.** 1012. **16.** 1202. **17.** 2001. **18.** 100. **19.** 101. **20.** 110. **21.** 1101. **22.** 1010. **23.** 1001. **24.** 1101.

Page 123. **1.** 53 lb. **2.** 48 lb. **3.** 94. **4.** 486. **5.** 121. **6.** 81. **7.** 102. **8.** 105. **9.** 601. **10.** 1401.

Page 124. **9.** 13; 4¢. **10.** 6; 2¢. **11.** 11; 2¢. **12.** 22, rem. 1. **13.** 11, rem. 2. **14.** 17. **15.** 13, rem. 2. **16.** 5, rem. 4. **17.** 13, rem. 3. **18.** 7, rem. 7. **19.** 7, rem. 1. **20.** 10, rem. 5. **21.** 190, rem. 1. **22.** 164. **23.** 1633, rem. 2.

Page 126. **7.** 32. **8.** 12. **9.** 24. **10.** 28. **11.** $\frac{1}{4}$. **12.** 4.

Page 128. **21.** 6. **22.** 126.

Page 129. **5.** 24 sq. in.; 20 in. **6.** 6 sq. in. **7.** 80 sq. ft.; 36 ft. **8.** 64. **9.** $\frac{1}{4}$; 4 sq. in.; 8 in.; 16 sq. in.; 16 in.

Page 130. **1.** 5. **2.** 10. **3.** 15. **5.** 3. **6.** 21.

Page 131. **7.** 12 ft.; 36 ft. **8.** 18 in.; 54 in. **9.** 25 ft.; 75 ft. **10.** 24 ft.; 72 ft. **11.** 26 in.; 78 in. **12.** 42 yd.; 126 yd. **13.** 81 yd.; 243 yd. **14.** 32 sq. in.; 96 sq. in. **15.** 36 sq. in.; 108 sq. in. **16.** 44 sq. ft.; 132 sq. ft. **17.** 62 sq. ft.; 186 sq. ft. **18.** 16 sq. yd.; 48 sq. yd. **19.** 160 sq. yd.; 480 sq. yd. **20.** 150 sq. ft.; 450 sq. ft. **21.** 200 sq. yd.; 600 sq. yd. **22.** 72; 36; 108. **23.** 288; 72; 216.

Page 133. **2.** 16. **3.** 2170. **4.** $11.80. **5.** $1.53. **6.** $1.72. **7.** $20.04; $30.06; $40.08; $250.50. **8.** $38.50; $77; $385. **9.** 75. **10.** 141. **11.** 780, rem. 7. **12.** 48. **13.** 59. **14.** 165. **15.** 289. **16.** 456. **17.** 18 in.; 54 in. **18.** 24 yd.; 72 yd. **19.** 36 sq. in.; 108 sq. in. **20.** 83 sq. yd.; 249 sq. yd. **21.** 864.

Page 134. I. **1.** 161. **2.** 145. **3.** 292. **4.** 423. **5.** 159. **6.** 274. **7.** 4071. **8.** 1218. **9.** 21. **10.** $3.55. **11.** 26. **12.** 42. II. **1.** 144. **2.** 181. **3.** 107. **4.** 673. **5.** 234. **6.** 395. **7.** 3724. **8.** 1650. **9.** 18. **10.** $5.64. **11.** 62. **12.** 85. III. **1.** 145. **2.** 131. **3.** 161. **4.** 163. **5.** 323. **6.** 522. **7.** 1556. **8.** 4704. **9.** 17. **10.** $8.35. **11.** 79. **12.** 97. IV. **1.** 158. **2.** 172. **3.** 674. **4.** 526. **5.** 165. **6.** 5762. **7.** 2584. **8.** 2565. **9.** $86.25. **10.** $5.64. **11.** 432. **12.** 81. V. **1.** 365. **2.** 270. **3.** 116. **4.** 177. **5.** 1024. **6.** 286. **7.** 5144. **8.** 3411. **9.** $284.16. **10.** 4. **11.** $960. **12.** 66.

Page 135. **14.** 40,000. **15.** 80,000. **16.** 100,000. **17.** 300,000. **18.** Ninety thousand. **19.** Fifty thousand. **20.** Seventy thousand. **21.** Sixty thousand. **22.** Thirty thousand. **23.** Eighty thousand. **24.** One hundred thousand. **25.** Two hundred thousand. **26.** Five hundred thousand.

Page 136. **18.** 14,800. **19.** 76,017. **20.** 69,089. **21.** 27,608. **22.** 434,243. **23.** Sixty-two thousand, two hundred ninety-six. **24.** Eighty-one thousand, sixty. **25.** Seventy-two thousand, four hundred twenty-eight. **26.** Sixty thousand, six. **27.** Ninety-nine thousand, nine hundred ninety-nine. **28.** Two hundred five thousand, two hundred five. **29.** 999,999. **30.** 1; 999,999.

Page 137. **14.** $469. **15.** $600.20. **16.** $7000.17. **17.** $1900.80. **18.** $1300.69. **19.** $7768.96. **20.** $77,389.94.

Page 138. **1.** 13. **2.** 64. **3.** 31. **4.** 71. **5.** 67. **6.** 98. **7.** 77. **8.** 34. **9.** XLI. **10.** LXIX. **11.** LXXII. **12.** LXXXI. **13.** XXXVII. **14.** XLV. **15.** CCLXXV. **16.** CLVI. **17.** MDCCCCXX, or MCMXX. **18.** MDCCCCXXV, or MCMXXV.

Page 139. **9.** 1, 6, 11, 16, 21, 26, 31, 36, 41, 46, 51; 2, 7, 12, 17, 22, 27, 32, 37, 42, 47, 52; 3, 8, 13, 18, 23, 28, 33, 38, 43, 48, 53; 4, 9, 14, 19, 24, 29, 34, 39, 44, 49, 54. **10.** 6, 12, 18, 24, 30, 36, 42, 48, 54, 60; 7, 14, 21, 28, 35, 42, 49, 56, 63, 70. **11.** 8, 16, 24, 32, 40, 48, 56, 64, 72, 80; 9, 18, 27, 36, 45, 54, 63, 72, 81, 90. **12.** 10, 20, 30, 40, 50, 60, 70, 80, 90, 100; 1, 11, 21, 31, 41, 51; 2, 12, 22, 32, 42, 52; 4, 14, 24, 34, 44, 54; 7, 17, 27, 37, 47, 57; 9, 19, 29, 39, 49, 59. **13.** 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000. **14.** 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000, 10,000.

Page 140. **12.** 1, 7, 13, 19, 25, 31, 37, 43, 49, 55, 61; 2, 8, 14, 20, 26, 32, 38, 44, 50, 56, 62; 3, 9, 15, 21, 27, 33, 39, 45, 51, 57, 63. **13.** 3, 12, 21, 30, 39, 48, 57, 66, 75, 84, 93; 4, 13, 22, 31, 40, 49, 58, 67, 76, 85, 94; 5, 14, 23, 32, 41, 50, 59, 68, 77, 86, 95. **14.** 1305. **15.** 1749. **16.** 1139. **17.** 1455. **18.** 1752. **19.** 1776. **20.** 1861. **21.** 1844. **22.** 1144. **23.** $12.07. **24.** $17.36. **25.** $14.31. **26.** $17.94. **27.** $18.35. **28.** $16.24.

Page 141. **12.** 4, 10, 16, 22, 28, 34, 40, 46, 52, 58, 64; 5, 11, 17, 23, 29, 35, 41, 47, 53, 59, 65. **13.** 3, 10, 17, 24, 31, 38, 45, 52, 59, 66, 73; 4, 11, 18, 25, 32, 39, 46, 53, 60, 67, 74; 5, 12, 19, 26, 33, 40, 47, 54, 61, 68, 75. **14.** 6, 14, 22, 30, 38, 46, 54, 62, 70, 78, 86; 7, 15, 23, 31, 39, 47, 55, 63, 71, 79, 87; 9, 17, 25, 33, 41, 49, 57, 65, 73, 81, 89, 97. **15.** 1554. **16.** 1776. **17.** 1525. **18.** 1760. **19.** 1090. **20.** 1196. **21.** 1477. **22.** 1364. **23.** 1621. **24.** $14.76. **25.** $18.27. **26.** $14. **27.** $32.27. **28.** $86.67. **29.** $106.44.

Page 142. **7.** $136.79. **8.** $78.95. **9.** $89.55. **10.** $71.25. **11.** $84.34. **12.** $215.50. **13.** $233. **14.** $211.33. **15.** $277.61. **16.** $299.29.

Page 143. **1.** 70¢. **2.** $1.75. **3.** $2. **4.** $2. **5.** $2. **6.** $3.60. **7.** $2.20. **8.** $2.60. **10.** $1.80. **11.** $3.50. **12.** $6.60. **13.** $6. **14.** $7.05.

Page 144. **1.** 2062. **2.** $1049.40. **3.** 18,966. **4.** $2662.40. **5.** $4. **6.** $14.10. **7.** 100; 172.

Page **145.** **13.** 287. **14.** $788. **15.** 280. **16.** 228. **17.** 415. **18.** 271. **19.** 148. **20.** 265. **21.** 494. **22.** 3592. **23.** 1591. **24.** 24,958. **25.** 23,907. **26.** 3547. **27.** 30,515. **28.** 27,574. **29.** 27,327.

Page **146.** **1.** $265.86. **2.** $2217.64. **3.** $2729.45. **4.** $713.60.

Page **147.** **11.** $21.91. **12.** $48.79. **13.** $18.67. **14.** $33.02. **15.** $23.92. **16.** $8.61. **17.** $69.48. **18.** $18.88. **19.** $37.14. **20.** $35.19. **21.** $38.74. **22.** $1.84. **23.** $13.40. **24.** $26.39. **25.** $21.83. **26.** $22.55. **27.** $24.20. **28.** $39.12. **29.** $59.58. **30.** $48.38. **31.** $73.71. **32.** $84.22. **33.** $3.38. **34.** $23.74.

Page **148.** **1.** 3764 ft.; 1516 ft. less. **2.** 2; second. **3.** 238. **4.** $1.62. **5.** 140.

Page **149.** **1.** $84,550. **2.** $39,672. **3.** $15,500. **4.** $24,272. **5.** $20,976. **6.** $14,000.

Page **151.** **1.** $20,000; $13,625; $30,000. **2.** $7020; $10,260; $7357.50; $8100. **3.** $61,607.20. **4.** $76,545. **5.** $100,266.66. **6.** $187,005.60. **7.** $295,432.60. **8.** $347,862.13. **9.** $206,134.14. **10.** $342,120.32. **11.** $216,938.40. **12.** $940,761.60. **13.** 232,560. **14.** 221,414. **15.** 533,610. **16.** 476,782. **17.** 807,312. **18.** 439,560. **19.** 450,147. **20.** 192,080. **21.** 293,364. **22.** 255,025. **23.** 395,850. **24.** 685,600. **25.** 275,000. **26.** 440,250. **27.** 225,600. **28.** 369,664. **29.** 322,890. **30.** 136,900. **31.** 436,000. **32.** 828,400. **33.** $47,398.40. **34.** $422,208. **35.** $111,407.64. **36.** $136,256.25. **37.** $285,460.56. **38.** $586,262.40. **39.** $196,652.80. **40.** $558,448.90. **41.** $115,875. **42.** $271,516.58.

Page **152.** **1.** 4042. **2.** 2888. **3.** 7524. **4.** 55,352. **5.** 69,256. **6.** 44,068. **7.** 72,048. **8.** 74,582. **9.** 38,076. **10.** 56,630. **11.** 68,096. **12.** 50,841. **13.** 131,508. **14.** 599,872. **15.** 205,233. **16.** 219,373. **17.** 229,216. **18.** 234,572. **19.** 334,475. **20.** 208,314. **21.** 369,246. **22.** 270,720. **23.** 309,600. **24.** $113.90. **25.** $292.46. **26.** $692.24. **27.** $327.78. **28.** $527.22. **29.** $606.32. **30.** $462. **31.** $393.12. **32.** $586.08. **33.** $539.56. **34.** $534.24. **35.** $530.48. **36.** $169.32. **37.** $320.07. **38.** $429.84. **39.** $568.55. **40.** $120.36. **41.** $414.72. **42.** $650.56. **43.** $626.22. **44.** $429.20. **45.** $748. **46.** $672.84. **47.** $1320.48. **48.** $4640.72. **49.** $1798.50. **50.** $1692.68. **51.** $2550.02. **52.** $4754.40. **53.** $2043.30. **54.** $5901.12. **55.** $1737.34. **56.** $1682.24. **57.** $5991.08. **58.** $3266.34. **59.** $1833.13. **60.** $2142. **61.** $1661.92. **62.** $1718.10. **63.** $2602.32. **64.** $6730.64. **65.** $2921.88. **66.** $4749.84. **67.** $5799.42. **68.** $5001. **69.** $2813.16.

Page **153.** **7.** 5; 9; 10; 12; 13; 14; 15. **8.** 17; 18; 21; 24; 25; 28; 33. **9.** 23. **10.** 13. **11.** 7. **12.** 7. **13.** 8. **14.** 12. **15.** 22. **16.** 27. **17.** 23. **18.** 60. **19.** 2. **20.** 9.

Page **154.** **55.** 67; 44, rem. 2; 33, rem. 2; 26, rem. 4; 22, rem. 2; 19, rem. 1; 16, rem. 6; 14, rem. 8. **56.** 128; 85, rem. 1; 64; 51, rem. 1; 42, rem. 4; 36, rem. 4; 32; 28, rem. 4. **57.** 286; 190, rem. 2; 143; 114, rem. 2; 95, rem. 2; 81, rem. 5; 71, rem. 4; 63, rem. 5. **58.** 348, rem. 1; 232, rem. 1; 174, rem. 1;

139, rem. 2; 116, rem. 1; 99, rem. 4; 87, rem. 1; 77, rem. 4. **59.** 137, rem. 1; 91, rem. 2; 68, rem. 3; 55; 45, rem. 5; 39, rem. 2; 34, rem. 3; 30, rem. 5. **60.** 170, rem. 1; 113, rem. 2; 85, rem. 1; 68, rem. 1; 56, rem. 5; 48, rem. 5; 42, rem. 5; 37, rem. 8. **61.** 194, rem. 1; 129, rem. 2; 97, rem. 1; 77, rem. 4; 64, rem. 5; 55, rem. 4; 48, rem. 5; 43, rem. 2. **62.** 400; 266, rem. 2; 200; 160; 133, rem. 2; 114, rem. 2; 100; 88, rem. 8. **63.** 163, rem. 1; 109; 81, rem. 3; 65, rem. 2; 54, rem. 3; 46, rem. 5; 40, rem. 7; 36, rem. 3. **64.** 188; 125, rem. 1; 94; 75, rem. 1; 62, rem. 4; 53, rem. 5; 47; 41, rem. 7. **65.** 452; 301, rem. 1; 226; 180, rem. 4; 150, rem. 4; 129, rem. 1; 113; 100, rem. 4. **66.** 150, rem. 1; 100, rem. 1; 75, rem. 1; 60, rem. 1; 50, rem. 1; 43; 37, rem. 5; 33, rem. 4. **67.** 243; 162; 121, rem. 2; 97, rem. 1; 81; 69, rem. 3; 60, rem. 6; 54. **68.** 195; 130; 97, rem. 2; 78; 65; 55, rem. 5; 48, rem. 6; 43, rem. 3. **69.** 426; 284; 213; 170, rem. 2; 142; 121, rem. 5; 106, rem. 4; 94, rem. 6. **70.** 234; 156; 117; 93, rem. 3; 78; 66, rem. 6; 58, rem. 4; 52. 71. 470; 313, rem. 1; 235; 188; 156, rem. 4; 134, rem. 2; 117, rem. 4; 104, rem. 4. **72.** 302; 201, rem. 1; 151; 120, rem. 4; 100, rem. 4; 86, rem. 2; 75, rem. 4; 67, rem. 1. **73.** 182; 121, rem. 1; 91; 72, rem. 4; 60, rem. 4; 52; 45, rem. 4; 40, rem. 4. **74.** 353, rem. 1; 235, rem. 2; 176, rem. 3; 141, rem. 2; 117, rem. 5; 101; 88, rem. 3; 78, rem. 5.

Page **155.** **1.** $55\frac{1}{4}$ lb. **2.** $49\frac{1}{3}$ in. **3.** $50\frac{2}{3}$ lb. **4.** $62\frac{2}{3}$ in. **5.** $27\frac{1}{3}$ ft. **6.** $57\frac{1}{3}$ ft. **7.** $17\frac{3}{4}$ in. **8.** $39\frac{3}{4}$ yd. **9.** $97\frac{1}{4}$ lb. **10.** 77 ft.

Page **156.** **1.** $48\frac{7}{10}$ lb. **2.** $55\frac{1}{10}$ lb. **3.** $7\frac{3}{10}$. **4.** $84\frac{1}{10}$. **5.** $689\frac{3}{10}$. **6.** $478\frac{7}{10}$. **7.** $889\frac{9}{10}$. **8.** $1247\frac{1}{10}$. **9.** $3607\frac{3}{10}$. **10.** $4000\frac{7}{10}$. **11.** $1848\frac{1}{4}$. **12.** $1562\frac{1}{2}$. **13.** $732\frac{3}{6}$. **14.** $1456\frac{1}{5}$. **15.** $885\frac{1}{7}$. **16.** $1029\frac{5}{8}$. **17.** $277\frac{3}{9}$. **18.** $1640\frac{3}{6}$. **19.** 1641. **20.** 408. **21.** $1287\frac{3}{6}$. **22.** $910\frac{5}{9}$. **23.** $1051\frac{5}{9}$. **24.** 2024. **25.** $478\frac{6}{7}$. **26.** $1383\frac{1}{7}$.

Page **159.** **1.** 12. **2.** 13. **3.** 112. **4.** 113. **5.** 122. **6.** 132. **7.** 432. **8.** 322. **9.** 331. **10.** 718. **11.** 66; 67; 77. **12.** 23; 33; 34. **13.** 59 lb.

Page **161.** **12.** 21. **13.** 33. **14.** 25. **15.** 117. **16.** 233. **17.** 15. **18.** 24. **19.** 19. **20.** 38. **21.** 111. **22.** 145. **23.** 166. **24.** 199. **25.** 52. **26.** 121. **27.** 23; 27; 31. **28.** 15; 23; 32.

Page **162.** **1.** 108. **2.** 206. **3.** 108.

Page **164.** **1.** 8. **2.** 8. **3.** 8. **4.** 7. **5.** 5. **6.** 9. **7.** 11. **8.** 9. **9.** 7. **10.** 8. **11.** 9. **12.** 8. **13.** 8. **14.** 10. **15.** 9. **16.** 92, rem. 34. **17.** 92, rem. 51. **18.** 58, rem. 38. **19.** 116, rem. 29. **20.** 82, rem. 11. **21.** 109, rem. 3. **22.** 112. **23.** 82, rem. 71. **24.** 66. **25.** 102, rem. 6. **26.** 106, rem. 36. **27.** 122, rem. 32. **28.** $82\frac{5}{8\,4}$. **29.** 114. **30.** 244. **31.** $219\frac{3}{4\,4}$. **32.** 91. **33.** $73\frac{4}{9\,1}$. **34.** 82. **35.** 132. **36.** $123\frac{2}{2\,9}$. **37.** $110\frac{8}{7\,4}$. **38.** 52. **39.** 72. **40.** 87. **41.** 29. **42.** 114. **43.** 112. **44.** 372. **45.** 365. **46.** 82. **47.** 93. **48.** $117\frac{8}{7\,3}$. **49.** $114\frac{3}{7\,9}$. **50.** $139\frac{5}{5\,3}$. **51.** $141\frac{8}{6\,1}$. **52.** $222\frac{9}{3\,1}$. **53.** $171\frac{2}{2\,3}$. **54.** 85. **55.** 28. **56.** $201\frac{4}{4\,9}$. **57.** $141\frac{3}{5\,2}$. **58.** $149\frac{3}{6\,3}$. **59.** $88\frac{6}{7\,4}$. **60.** $110\frac{2}{5\,9}$.

Page 165. **1.** 63 bu. **2.** 57 lb. **3.** $64. **4.** $31. **5.** 24. **6.** $17. **7.** 37; 39. **8.** 42 mi. **9.** 17. **10.** 63. **11.** 20; $30.

Page 166. **1.** $22.75. **2.** $0.76. **3.** $3.26. **4.** $3.88. **5.** $1.46. **6.** $1.37. **7.** $1.37. **8.** $1.33. **9.** $0.62. **10.** $1.20. **11.** $0.28. **12.** $0.48. **13.** $0.62. **14.** $0.31. **15.** $0.62.

Page 167. **1.** 16 min. **2.** 44. **3.** 125. **4.** 49. **5.** 1375; 55. **6.** $4.25. **7.** $13.51. **8.** $0.16. **9.** $63.10. **10.** 180. **11.** 160.

Page 168. **1.** $1.93. **2.** 14,518. **3.** 24. **4.** 102. **5.** No. **6.** $1.51. **7.** 1932, rem. 36. **8.** 33. **9.** 7. **10.** 33. **11.** 8. **12.** 25. **13.** 31. **14.** 178. **15.** 185, rem. 10. **16.** 108. **17.** 32, rem. 49. **18.** 122. **19.** 192. **20.** $1.61. **21.** $1.20. **22.** 448, rem. 41. **23.** 613, rem. 1. **24.** 2430. **25.** 1964. **26.** 607. **27.** 648. **28.** 329. **29.** 1111. **30.** 793. **31.** 1633. **32.** 649. **33.** 3302. **34.** 926. **35.** 934. **36.** 507. **37.** 111.

Page 171. **5.** 24¢; 6¢; 48¢. **6.** 320; 640. **7.** 80¢; $3.20. **8.** 150.

Page 172. **10.** 720. **11.** 1440. **12.** 30; 90; 150.

Page 174. **1.** 185; 190; 195. **2.** 30. **3.** 1170. **4.** $8\frac{1}{2}$ hr. **6.** 420; **7.** **7.** 480; **8.** **8.** 2 hr. **9.** 30.

Page 175. **1.** 2. **2.** 4. **3.** $\frac{1}{2}$. **4.** 30 in. **5.** 30 in.; yes. **6.** $7\frac{1}{4}$ in. **7.** $14\frac{1}{4}$. **8.** $15\frac{1}{2}$.

Page 178. **15.** 80. **16.** 92. **17.** 64. **18.** $27.

Page 179. **10.** 6; 12. **11.** 8; 16. **12.** 13; 26. **13.** 14; 28. **14.** 150; 300. **15.** 6; 12; 18; 24. **16.** 9; 18; 27; 36. **17.** 10; 20; 30; 40. **18.** 11; 22; 33; 44. **19.** 120; 240; 360; 480. **20.** 72. **21.** 90. **22.** 123. **23.** 135. **24.** 270. **25.** 66. **26.** 99. **27.** 132. **28.** 216. **29.** 246. **30.** 115. **31.** 170. **32.** 230. **33.** 370. **34.** 465. **35.** 434. **36.** 441. **37.** 497. **38.** 742. **39.** 847.

Page 180. **1.** 45. **2.** 27. **3.** 198. **4.** $1500. **5.** 438. **6.** 56. **7.** 6; 18. **8.** 42 lb.; 210 lb. **9.** 8. **10.** Too little; 38.

Page 183. **1.** 28,000. **2.** Ninety thousand, three hundred seventy. **3.** $2000.06. **5.** $223.24. **6.** $2288.23. **7.** $2487.31. **8.** $1939.98. **9.** $2716.97. **10.** 36,904. **11.** 326. **12.** 64,292. **13.** 22,477. **14.** 25,378. **15.** $2081.75. **16.** $2,228,852.80; $1,609,148.40; $4,686,840. **17.** 130. **18.** 114. **19.** 88, rem. 36. **20.** 352, rem. 16. **21.** $1.94. **22.** $0.62. **23.** 68 qt.; $4\frac{1}{4}$ gal. **24.** 348; 285; 460; 861.

Page 184. I. **1.** 10,547. **2.** $12.43. **3.** 2374. **4.** 292,502. **5.** 162,624. **6.** 602,875. **7.** 205. **8.** 91. **9.** 9. **10.** 9. **11.** 320. **12.** 2432. II. **1.** 10,304. **2.** $8.60. **3.** 2513. **4.** 236,908. **5.** 380,596. **6.** 671,240. **7.** 205. **8.** 66. **9.** 11. **10.** 570. **11.** 20. **12.** 2074. III. **1.** 12,461. **2.** $13.84. **3.** 6118. **4.** 299,882. **5.** 563,626. **6.** 615,252. **7.** 129. **8.** 16. **9.** 28, rem. 36. **10.** 236. **11.** 30. **12.** 5463. IV. **1.** 12,641. **2.** $12.37. **3.** 4844. **4.** 781,231. **5.** 344,172.

se

6. 616,830. **7.** 159. **8.** 24. **9.** 24. **10.** 391,000. **11.** 21,600. **12.** 160. **13.** 219. **14.** 4230. **15.** 136, rem. 12. V. **1.** 10,167. **2.** $10.87. **3.** 6065. **4.** 213,138. **5.** 726,960. **6.** 885,428. **7.** 324,000. **8.** 133. **9.** 111. **10.** 109. **11.** 45. **12.** 6. **13.** 96. **14.** 2. **15.** 3,696,000.

Page 185. **9.** 85,216. **10.** 400,461. **11.** 655,079. **12.** 999,900. **13.** Three hundred six thousand, eighty-four. **14.** Two hundred seventy thousand, seventy-two. **15.** Three hundred thousand, three. **16.** Five hundred twenty-seven thousand, three hundred sixty-eight. **17.** Five hundred thousand, five hundred. **18.** Nine hundred nine thousand, nine hundred nine.

Page 186. **7.** 13,002,018. **8.** 72,000,630. **9.** 42,007,007. **10.** 567,000,000. **11.** 415,000,700. **12.** 9,003,406.

Page 187. **1.** 169,929 sq. mi. **2.** 13,510 lb. **3.** 146; 2 hr. 26 min. **4.** $1904.53. **5.** $2066.60. **6.** $3167.79. **7.** $2223.70.

Page 188. **1.** 485. **2.** 450. **3.** 1299. **4.** 534. **5.** $354. **6.** $575.23. **7.** $353.84. **8.** $334.22. **9.** $574.71. **10.** $22,452.42.

Page 189. **1.** $9.73. **2.** $19.25. **3.** $330. **4.** $22,995. **5.** $288.10. **6.** $629.80; $763.80. **7.** $159,300; $167,400. **8.** $310,800; $214,200. **9.** $11,480; $12,600. **10.** $53,625; $72,572.50; $103,317.50; $121,550. **11.** $625,125; $635,127; $918,933.75; $1,053,960.75.

Page 191. **1.** 130. **2.** 341. **3.** 304. **4.** 224. **5.** 670. **6.** 430. **7.** 509. **8.** 207. **9.** 533. **10.** 414. **11.** 381. **12.** 462. **13.** 343. **14.** 353. **15.** 379. **16.** 301. **17.** 146. **18.** 235. **19.** 335. **20.** 456. **21.** 496. **22.** 125. **23.** 313. **24.** 276. **25.** 254. **26.** 309. **27.** 339. **28.** 348. **29.** 426. **30.** 345. **31.** $9. **32.** $52. **33.** $353.

Page 192. **1.** 30. **2.** $30\frac{7}{300}$. **3.** $30\frac{107}{300}$. **4.** 32. **5.** $32\frac{9}{2000}$. **6.** $32\frac{109}{2000}$. **7.** $32\frac{207}{3000}$. **8.** 51. **9.** $31\frac{111}{7000}$. **10.** 50.

Page 194. **1.** $7.60. **2.** 15¢. **3.** 33¢. **4.** 27. **5.** 39; 5. **6.** 74. **7.** 3 tons. **8.** $3.20. **9.** $10.80.

Page 196. **5.** 80. **6.** 80. **7.** 40. **8.** 880. **9.** 192; 6; 198. **10.** 2640. **11.** 63,360.

Page 197. **10.** 16; 16. **11.** 240. **12.** 1176 sq. ft. **13.** 2432 sq. yd. **14.** 9520 sq. ft. **15.** 864 sq. yd. **16.** 4608 sq. ft. **17.** 18,432 sq. ft.

Page 198. **8.** 9 sq. ft.; 1 sq. yd.; 1296 sq. in.

Page 201. **3.** 1 in. to 10 ft. **4.** 16. **5.** 240. **6.** 680. **7.** 144 sq. ft. **8.** 448 sq. ft. **9.** 1134 sq. in. **10.** 576 sq. yd. **11.** 1368 sq. ft. **12.** 1632 sq. in. **13.** 5712 sq. in. **14.** 1728 sq. yd.

Page 203. **6.** 1620. **7.** 608. **8.** 384. **9.** 360.

Page **205.** **5.** \$300; \$450. **6.** \$544; \$680. **7.** \$8.90; \$62.30. **8.** \$148; \$222. **9.** \$134.75; \$462. **10.** \$148.75. **11.** \$232.70; \$189.80; \$202.80; \$162.50. **12.** \$12.90.

Page **207.** **5.** 240 qt. **6.** 560 qt. **7.** 22 qt. **8.** 19 qt. **9.** 720 qt. **10.** 90 qt. **11.** 2 qt. **12.** 6 qt. **13.** 2 ft. **14.** 72 ft. **15.** 3 ft. **16.** 108 ft. **17.** 6 in. **18.** 84 in. **19.** 9 in. **20.** 252 in. **21.** 42; 50.

Page **208.** **11.** 57. **12.** 1944. **13.** 22. **14.** 365; $52\frac{1}{7}$.

Page **211.** **6.** 27¢. **7.** 36¢. **8.** 57¢. **9.** 115¢. **10.** 288¢. **11.** 144¢. **12.** 256¢. **13.** 360¢. **14.** 420¢. **15.** 348¢. **16.** 55 ft. **17.** 78 yd. **18.** 162 in. **19.** 284 lb. **20.** 292 doz.

Page **216.** **1.** \$12. **2.** \$88. **3.** 10. **4.** 24. **5.** 90. **6.** 48. **7.** 9. **8.** 9.

Page **217.** **1.** 2. **2.** 3. **3.** 4. **4.** $1\frac{1}{2}$. **5.** $2\frac{1}{2}$. **6.** 1. **7.** 2. **8.** 3. **9.** $1\frac{1}{3}$. **10.** $2\frac{1}{3}$. **11.** 2. **12.** $2\frac{1}{4}$. **13.** $1\frac{1}{4}$. **14.** $1\frac{3}{4}$. **15.** 1. **16.** $1\frac{1}{8}$. **17.** 3. **18.** 2. **19.** 5. **20.** $1\frac{1}{3}$.

Page **218.** **1.** $19\frac{1}{2}$ in. **2.** 39. **3.** $11\frac{1}{3}$. **4.** 40. **5.** 10. **6.** $11\frac{1}{2}$. **7.** $68\frac{1}{3}$. **8.** 59. **9.** 48. **10.** $57\frac{2}{3}$.

Page **219.** **8.** $\frac{3}{4}$. **9.** $\frac{1}{4}$. **10.** $\frac{1}{4}$. **11.** $1\frac{1}{4}$. **12.** $\frac{3}{8}$. **13.** $\frac{1}{8}$. **14.** $\frac{7}{8}$. **15.** $\frac{5}{8}$. **16.** $\frac{3}{8}$. **17.** $\frac{5}{8}$. **18.** $\frac{1}{8}$. **19.** $\frac{1}{8}$. **20.** $\frac{5}{8}$. **21.** $\frac{3}{8}$. **22.** $\frac{3}{3}$. **23.** $\frac{5}{6}$.

Page **222.** **1.** $5\frac{3}{4}$ yd. **2.** $1\frac{1}{8}$ yd. **3.** $1\frac{3}{8}$ in. **4.** $\frac{1}{16}\frac{5}{}$ yd. **5.** $2\frac{5}{8}$ in. **6.** $10\frac{3}{8}$ in. **7.** $4\frac{1}{8}$ ft. **8.** 4. **9.** 7. **10.** $7\frac{5}{8}$. **11.** $9\frac{1}{4}$. **12.** $12\frac{1}{5}$. **13.** $7\frac{7}{8}$. **14.** $14\frac{3}{8}$. **15.** $8\frac{1}{8}$. **16.** $60\frac{3}{4}$. **17.** $14\frac{3}{4}$. **18.** $11\frac{7}{8}$. **19.** 13. **20.** 16. **21.** $19\frac{1}{2}$. **22.** $6\frac{3}{3}$. **23.** $8\frac{1}{4}$. **24.** $7\frac{1}{2}$. **25.** $8\frac{1}{2}$. **26.** $16\frac{1}{8}$. **27.** $9\frac{1}{2}$. **28.** $6\frac{1}{2}$. **29.** $16\frac{5}{8}$. **30.** $11\frac{1}{8}$. **31.** $15\frac{7}{12}$. **32.** $8\frac{5}{6}$. **33.** $6\frac{1}{12}$. **34.** $9\frac{1}{3}$.

Page **223.** **1.** $5\frac{1}{4}$ yd. **2.** $3\frac{7}{8}$; $1\frac{5}{8}$. **3.** $5\frac{1}{12}$; $2\frac{3}{8}$. **4.** $7\frac{1}{3}$ in. **5.** $2\frac{1}{4}$ yd. **6.** $7\frac{1}{4}$ in. **7.** $5\frac{1}{2}$. **8.** $2\frac{1}{2}$. **9.** $4\frac{2}{3}$. **10.** $5\frac{1}{3}$. **11.** 5. **12.** 5. **13.** $4\frac{1}{3}$. **14.** 2. **15.** $10\frac{3}{4}$. **16.** $10\frac{1}{4}$. **17.** $9\frac{1}{3}$. **18.** 28.

Page **224.** **1.** $1\frac{1}{8}$ yd. **2.** $\frac{3}{16}$ in. **3.** $\frac{7}{16}$ in. **4.** $10\frac{3}{4}$ yd. **5.** $8\frac{1}{4}$ yd. **6.** $6\frac{5}{8}$ in.

Page **225.** **1.** 52; 104. **2.** 210; 420. **3.** 160; 320. **4.** 65; 130. **5.** 195; 260. **6.** 56; 280. **7.** $13\frac{1}{4}$. **8.** $14\frac{9}{10}$. **9.** $7\frac{5}{8}$. **10.** $8\frac{3}{8}$. **11.** $16\frac{5}{8}$. **12.** $12\frac{1}{2}$. **13.** $10\frac{4}{9}$. **14.** $11\frac{4}{9}$. **15.** $24\frac{1}{2}$. **16.** $22\frac{3}{16}$. **17.** $17\frac{7}{10}$. **18.** $18\frac{1}{2}$. **19.** $6\frac{1}{3}$. **20.** $3\frac{1}{4}$. **21.** $3\frac{3}{4}$. **22.** $3\frac{1}{12}$. **23.** $3\frac{1}{8}$. **24.** $3\frac{7}{8}$. **25.** $23\frac{1}{5}$. **26.** $26\frac{1}{12}$. **27.** $6\frac{1}{10}$. **28.** $\frac{1}{16}\frac{3}{}$ in. **29.** $9\frac{1}{8}$ yd. **30.** 97; $18\frac{1}{3}$. **31.** $86\frac{5}{6}$; $7\frac{1}{2}$. **32.** $132\frac{1}{3}$; 47. **33.** $167\frac{7}{12}$; $28\frac{1}{12}$. **34.** $106\frac{5}{8}$; $13\frac{5}{8}$. **35.** $28\frac{5}{6}$; $12\frac{1}{6}$. **36.** $72\frac{3}{8}$; $13\frac{3}{8}$. **37.** $96\frac{1}{12}$; $37\frac{7}{12}$. **38.** $85\frac{1}{12}$; $26\frac{7}{12}$. **39.** $149\frac{5}{12}$; $12\frac{1}{12}$.

Page **226.** **1.** $1\frac{3}{4}$ hr. **2.** $66\frac{1}{2}$. **3.** $5\frac{1}{2}$ mi. **4.** \$1.34.

Page **228.** **1.** \$4.87. **2.** \$49.94. **3.** \$4.87. **4.** \$2.31. **5.** \$7.19.

Page **230.** **1.** \$4.10. **2.** \$5.20. **3.** \$810.32. **4.** \$256.86. **5.** \$755.60. **6.** \$2077.10. **7.** \$1243.48. **8.** \$592.70. **9.** \$647.42.

Page **232.** **1.** \$2158. **2.** \$193.60. **3.** \$739.20. **4.** \$262.75. **5.** 2112. **6.** \$27.36. **7.** \$469.20. **8.** \$171. **9.** \$6.12. **10.** \$1392.

Page 233. 1. $41.75. 2. $2.35; $2.65. 3. $2.55. 4. $2.90.

Page 234. 1. $6.36. 2. $6.15. 3. $13.40. 4. $10.25. 5. $0.64. 6. $22.05. 7. $6.15.

Page 235. 1. $14.40. 2. $6.70. 3. $27.88. 4. 387 mi. 5. 3 hr. 6. 33. 7. $0.57. 8. $2451. 9. 7. 10. 115.

Page 237. 1. 47,000,054. 2. Three million, one hundred forty-two thousand, seven. 3. $1168.49. 4. $2310.65. 5. $2167.07. 6. $11,480.14. 7. $40.76. 8. $222.55. 9. $856.14. 10. $5894.44. 11. $69,750; $103,230. 12. 524; $699\frac{108}{200}$; $691\frac{108}{200}$. 13. $21.60. 14. 3960 ft.; 1320 yd.; 240 rd. 15. 80 sq. rd. 16. 200 sq. ft. 17. 7 cu. yd. 18. 30 T. 19. $16\frac{1}{8}$.

Page 238. I. 1. 17,091. 2. 3988. 3. $101.71. 4. $37.38. 5. $112.48. 6. $5025. 7. $3022.50. 8. 509,450. 9. 1448. 10. 2160. II. 1. 13,934. 2. 2726. 3. $163.74. 4. $32.72. 5. $3220.28. 6. $6960. 7. $4722.64. 8. 383,460. 9. 61. 10. 2376. III. 1. 15,571. 2. 2254. 3. $277.27. 4. $41.36. 5. $653.33. 6. $5629.60. 7. $19,275.84. 8. 624,805. 9. 276. 10. 2. 11. 76. 12. $2038\frac{1}{2}$. IV. 1. 15,917. 2. 3361. 3. $163.10. 4. $81.21. 5. $835.92. 6. $8352. 7. $304,628.14. 8. 20,506,984. 9. 335, rem. 58. 10. 414. 11. 34. 12. $324.48.

Page 239. 1. 15,523. 2. 2254. 3. 9468. 4. 10,673. 5. 11,607. 6. 11,859. 7. 8821. 8. 10,865. 9. 17,371. 10. 10,828. 11. 13,229. 12. 10,298. 13. 15,074. 14. 11,795. 15. 7855. 16. 14,035. 17. 7787. 18. 13,420. 19. 13,835. 20. 6579. 21. $111.10. 22. $703.15. 23. 18,121. 24. 10,462. 25. $147.64. 26. $1548.20. 27. $142.56. 28. $138.23. 29. $134.45. 30. $146.46. 31. 1607. 32. 1876. 33. 2279. 34. 1814. 35. $21.01. 36. $130.16. 37. $59.50. 38. $866.95. 39. $195.83. 40. $1268.91.

Page 240. 1. 4732. 2. 2234. 3. 2362. 4. 3117. 5. 5644. 6. 1317. 7. 3865. 8. 4019. 9. 2908. 10. 4304. 11. 1472. 12. 4778. 13. 4016. 14. 3123. 15. 3945. 16. 1144. 17. 3228. 18. 2793. 19. 4581. 20. 4920. 21. $183.21. 22. $274.22. 23. $339.12. 24. $330.84. 25. $641.93. 26. $514.28. 27. $216.49. 28. $102.22. 29. $575.75. 30. $384.72. 31. $102.13. 32. $318.67. 33. $385.69. 34. $435.29. 35. $271.24. 36. $324.08. 37. $287.44. 38. $1652.23. 39. $1517.34. 40. $166.32.

Page 241. 1. 6794. 2. 2560. 3. 3268. 4. 8160. 5. 2528. 6. 3168. 7. 4980. 8. 5600. 9. 7488. 10. 3026. 11. 14,824. 12. 32,277. 13. 69,888. 14. 39,278. 15. 59,866. 16. 73,377. 17. 55,342. 18. 42,625. 19. 54,912. 20. 92,628. 21. 52,800. 22. 199,424. 23. 631,728. 24. 194,884. 25. 454,096. 26. 355,888. 27. 399,456. 28. 516,972. 29. 675,054. 30. 194,552. 31. 205,988. 32. 240,834. 33. 241,087. 34. 592,560. 35. 648,292. 36. 321,480. 37. 340,176. 38. 613,350. 39. 435,896. 40. 358,826. 41. $797.04. 42. $615.12. 43. $304.68. 44. $371.84. 45. $635.25. 46. $532.92. 47. $882.63. 48. $630.72. 49. $518.88. 50. $636.72.

51. $656.25. **52.** $1663.28. **53.** $990.34. **54.** $4495.12. **55.** $2211.12. **56.** $2316.16. **57.** $3857.76. **58.** $3458.88. **59.** $2275.06. **60.** $4582.48.

Page 242. **1.** 52, rem. 12. **2.** 51, rem. 6. **3.** 39, rem. 8. **4.** 20, rem. 18. **5.** 25, rem. 32. **6.** 17, rem. 34. **7.** 16, rem. 32. **8.** 49, rem. 12. **9.** 23, rem. 34. **10.** 26, rem. 16. **11.** 93, rem. 30. **12.** 108, rem. 30. **13.** 296, rem. 14. **14.** 270, rem. 29. **15.** 188, rem. 24. **16.** 191, rem. 21. **17.** 95, rem. 25. **18.** 98, rem. 10. **19.** 100, rem. 71. **20.** 85, rem. 74. **21.** 150. **22.** 148, rem. 25. **23.** 100, rem. 30. **24.** 110, rem. 32. **25.** 45, rem. 17. **26.** 166, rem. 12. **27.** 95, rem. 55. **28.** 39, rem. 48. **29.** 100, rem. 8. **30.** 156, rem. 46. **31.** 80. **32.** 101. **33.** 160. **34.** 60. **35.** 54, rem. 63. **36.** 42, rem. 8. **37.** 171, rem. 13. **38.** 45, rem. 52. **39.** 76, rem. 17. **40.** 19, rem. 19. **41.** $0.24. **42.** $0.24. **43.** $24.31. **44.** $0.72. **45.** $0.36. **46.** $1.31. **47.** $8.19. **48.** $2.03. **49.** $222. **50.** $383. **51.** $272, rem. $6. **52.** $416, rem. $10. **53.** $257, rem. $13. **54.** $52, rem. $2. **55.** $213, rem. $10. **56.** $90, rem. $15. **57.** $97, rem. $51. **58.** $205, rem. $7. **59.** $352. **60.** $152, rem. $16.

Page 243. **1.** $\frac{2}{4}$. **2.** $\frac{2}{8}$. **3.** $\frac{2}{6}$. **4.** $\frac{2}{16}$. **5.** $\frac{6}{16}$. **6.** $\frac{6}{8}$. **7.** $\frac{4}{8}$. **8.** $\frac{3}{9}$. **9.** $\frac{10}{16}$. **10.** $\frac{28}{32}$. **11.** $\frac{7}{8}$. **12.** $\frac{7}{8}$. **13.** $1\frac{5}{8}$. **14.** $1\frac{1}{8}$. **15.** $1\frac{3}{8}$. **16.** $\frac{5}{6}$. **17.** $1\frac{1}{6}$. **18.** $1\frac{5}{12}$. **19.** $1\frac{3}{24}$. **20.** $1\frac{1}{15}$. **21.** $2\frac{1}{4}$. **22.** $3\frac{1}{4}$. **23.** $1\frac{5}{8}$. **24.** $4\frac{7}{8}$. **25.** $3\frac{1}{8}$. **26.** $2\frac{7}{8}$. **27.** $3\frac{1}{10}$. **28.** $2\frac{11}{15}$. **29.** $4\frac{5}{6}$. **30.** $4\frac{1}{12}$. **31.** $1\frac{1}{8}$. **32.** $1\frac{3}{8}$. **33.** $1\frac{7}{8}$. **34.** $2\frac{1}{8}$. **35.** $\frac{17}{24}$. **36.** $1\frac{7}{24}$. **37.** $2\frac{7}{24}$. **38.** $1\frac{1}{30}$. **39.** $1\frac{7}{30}$. **40.** $1\frac{29}{30}$. **41.** 313. **42.** 176. **43.** 402. **44.** 206. **45.** 417. **46.** 121. **47.** 99. **48.** 310. **49.** 511. **50.** 231. **51.** $6\frac{1}{4}$. **52.** $1\frac{1}{4}$. **53.** $8\frac{7}{8}$. **54.** $2\frac{7}{8}$. **55.** $12\frac{1}{6}$. **56.** $2\frac{1}{6}$. **57.** $8\frac{5}{8}$. **58.** $1\frac{5}{8}$. **59.** $9\frac{11}{12}$. **60.** $3\frac{11}{12}$.

Page 244. **1.** 36 in. **2.** 108 in. **3.** 192 in. **4.** 90 in. **5.** 25 ft. **6.** $13\frac{1}{2}$ ft. **7.** 27 in. **8.** 126 in. **9.** $16\frac{1}{2}$ ft. **10.** 33 ft. **11.** $5\frac{1}{2}$ yd. **12.** 33 yd. **13.** 480 rd. **14.** 1280 rd. **15.** 1760 yd. **16.** 880 yd. **17.** 5280 ft. **18.** 11,880 ft. **19.** 3520 ft. **20.** 3960 ft. **21.** 32 oz. **22.** 4 oz. **23.** 36 oz. **24.** 1 lb. **25.** 9 lb. **26.** 18 lb. **27.** 4000 lb. **28.** 6500 lb. **29.** 14 pt. **30.** 17 pt. **31.** 12 qt. **32.** 23 qt. **33.** 54 pt. **34.** 12 pk. **35.** 22 pk. **36.** 16 qt. **37.** 28 qt. **38.** 288 sq. in. **39.** 27 sq. ft. **40.** 570 min.

Goodwill Books.Com
Your purchases change lives
$1.99
2001995 616 01/29
C0-EKL-408